



# Surface Water Portal Proposed Project Plan

For Monterey Peninsula Water Management District (MPWMD)

## Executive Summary

Tierra Plan (TP) met with MPWMD staff on September 15, 2022, to discuss a potential surface water management web portal. Based on that meeting and email correspondence, we have outlined this proposed project plan and estimate of the scope of work.

The agency wants a modern system for data sharing and visualization to meet these general requirements:

- Make their sensor data easily accessible to agency staff, partner agencies, researchers, and the interested public.
- Eliminate manual processes for responding to requests and provide an online tool for downloading data for one or multiple sensors
- MPWMD has seen the surface water website TP developed for Santa Clara Valley Water (VW) and would like a similar interface for station mapping, charts, and data sharing.
  - Map-based view of their 17 or so stream and rain gauge sensors showing latest real-time readings.
  - Real-time, interactive data plots (graphs) for each station.
- Implement an automated process that extracts data from Hydstra and Loggernet to a central data repository (database) that can support the web interfaces (charts, maps, downloads etc.)

Our solution provides a sustainable solution and the following key outcomes:

- Inform and engage the public through a simple interactive map and consolidated water data platform,
- Be future-proof and highly scalable,
- Bring current and historic surface water data to life through maps and graphics
- Increase public participation through an improved user experience.

We believe in a collaborative and engaging project management approach. **MPWMD staff will participate in the website design and development process from day one.**

- We will closely coordinate with MPWMD staff for design guidelines and preferences at

the onset of the project.

- MPWMD staff will be able to continually test and evaluate features during development and provide feedback on features and data.
- Regular progress reviews and an open communication channel will allow us to implement feedback quickly.
- We utilize an online collaborative project management tool for tracking milestones, tasks, progress, bugs, and a source code repository.

Our approach ensures a very fluid and flexible development process where each module can be developed and refined with constant input from the stakeholders. This makes deployment and launch at the end of the project much easier. We do not take a black-box approach to application development. Throughout the project, the map and alert interfaces will be available on our servers for MPWMD to evaluate, test, and provide feedback.

There are **four major components** to the water platform:

## DATA ACTIVITIES

We understand sensor data is currently stored in Loggernet and accessed via Hydstra. We would assess both systems to determine what capabilities are available for querying and/or extracting historic data and hourly data. A process will be developed to access and extract data, and will include designing a small database to store and process station data for the web site and API. There would be two types of data extract:

- Pulling historic records for every sensor and storing them in the database. This likely would be a one-time process.
- Pulling hourly or daily data used in web map and charts. Depending on what Hydstra supports this might be done by querying the Hydstra source directly, or through a server task that exports or pulls data on a schedule.

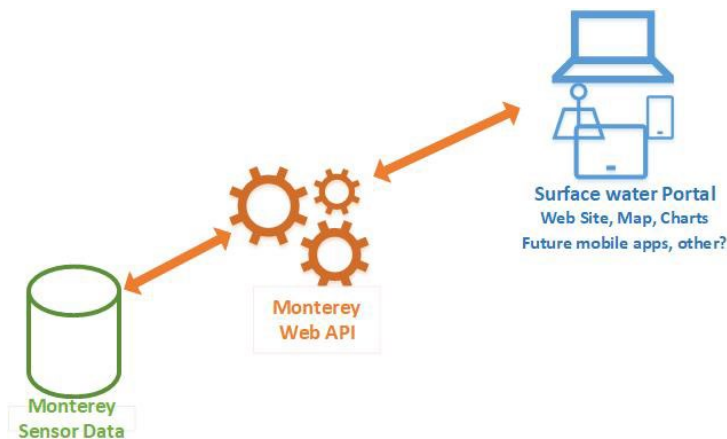
Data processes like this are often called Extract-Transform-Load (ETL) in software lingo.

### Backend Console ETL Application

In the background there will be one or more small console applications that run on a server with access to Hydstra and/or the Loggernet data. The console application is a small executable program we create that extracts raw data directly from Hydstra, or from Hydstra file exports, then transforms and processes the data as needed. And finally loads it into the database. Hence the term ETL This data application typically runs as a Windows scheduled task, and we would develop it to integrate with any scripts and processes you implement in Hydstra.

## WEB API

The next component is developing what is known as a “Web API” for connecting the website to the data store. This is an industry standard approach for sharing data across the internet between databases, web sites and mobile apps. The API acts as a “middle-man” between the data and the web. It handles all requests for a piece of data, connects to the database and gets the data, then formats the data into an internet standard called JSON, and sends it back to the website. This ensures that the source data is kept secure from the public, and only data intended to be used by a site can be queried and returned.



The Web API is also highly scalable. In addition to handling the data requests for the web map and charts, the Web API also supports allowing users to request and download large data sets. A researcher could, for example, download ten years for streamflow data for any sensor.

The Valley Water system we developed includes a Web API. Use the links below to explore it and try out the data download page as a demonstration.

<https://alertdata.valleywater.org/download.html>

<https://alertdata.valleywater.org/api.html>

## WEBSITE

The most visible component is obviously the website. We can use much of the framework in the Valley Water website where appropriate. Those features include the web-mapping components, charting, sensor data views, and the side-panel navigation and tools. For MPWMD we would implement a different design and styling that follows your main website and style guide.

The website is developed following an approach called **responsive design**. This means the site

is developed to work across multiple devices and screen sizes. It will be easy to navigate and use on a smartphone, tablet, and desktop computer. Early in the project our designer will provide three or four sets of screen mockups that represent the site design in desktop and mobile views. A round of revisions can follow and then once the design and user experience is acceptable, we will begin programming and development.

The MPWMD site can include the following features. Please reference the VW site for examples. For MPWMD the interface will be somewhat cleaner than the VW example since we aren't including flood and forecast related data.

- Tools panel
  - Tools in a side-panel on desktop browsers, and in a vertical slidable panel on mobile screens.
  - Toggle between the map and list views. The sensor list view is sortable by name, rating, stage, type, or whatever data is included in the list.
  - Select stage or rating for stream and reservoir labels; select timeframe for rain sensor labels.
  - Sensor search box to allow finding a sensor by name or sensor ID.
- Map
  - MPWMD sensors displayed with actionable, dynamic icons as described in the section below.
  - Basemap tool for switching between streets, satellite, and other basemaps
  - GIS data layers can be added such as watershed boundaries, agency boundaries, stream systems, lithology, etc.
  - Map navigation works with touch gestures and mouse events.
- Sensor data panel.
  - Selecting a sensor will open a panel that displays data in an interactive chart and table view. There would be a default time range for the initial data display, but users can customize the time range.
  - Data is also viewed in a tabular form.
  - Data can be exportable to a CSV, PDF, or an image.
  - An information tab with sensor meta-data and a photo if desired.



### Los Gatos Creek at Lincoln Ave (Stream Sensor 5050)

All times are in Pacific Standard Time (PST), which is one hour earlier than Pacific Daylight Time (PDT)



Sensor data charts are dynamic and can be exported to different formats.

### Los Gatos Creek at Lincoln Ave (Stream Sensor 5050)

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Graph Table Info

Start/End: 9/12/2022 to 9/19/2022

Export to CSV

Updated (PST)	Stage (ft)	Flow (cfs)
9/19/2022 12:15 PM	5.17	8.39
9/19/2022 12:00 PM	5.18	8.61
9/19/2022 11:45 AM	5.18	8.61
9/19/2022 11:30 AM	5.18	8.61
9/19/2022 11:15 AM	5.18	8.61
9/19/2022 11:00 AM	5.19	8.84
9/19/2022 10:45 AM	5.19	8.84
9/19/2022 10:30 AM	5.2	9.07
9/19/2022 10:15 AM	5.2	9.07
9/19/2022 10:00 AM	5.21	9.29
9/19/2022 9:45 AM	5.21	9.29
9/19/2022 9:30 AM	5.22	9.52
9/19/2022 9:15 AM	5.22	9.52
9/19/2022 9:00 AM	5.22	9.52
9/19/2022 8:45 AM	5.22	9.52
9/19/2022 8:30 AM	5.23	9.76
9/19/2022 8:15 AM	5.23	9.76
9/19/2022 8:00 AM	5.24	9.99

Sensor data can also be viewed in a table and exported to CSV



The platform will include the following gages to start with, but MPWMD staff can easily add additional sensors in the future:

- Five Carmel river real time stream gages
- Two USGS gages
- Three rain gages
- Two reservoir gages

## Carmel River Health Dashboard

A key feature of the water portal will include a dynamic and interactive river health dashboard. This single page view will include a regional map highlighting the Carmel river basin including the latest sensor data, interactive charts, sortable data tables, data downloads, boundaries, river and tributaries, sensor descriptions, and other key environmental data. The intent is to bring much of the content currently linked under <https://www.mpwmd.net/environmental-stewardship/carmel-river-basin/> to life in a consolidated, informative visual format.

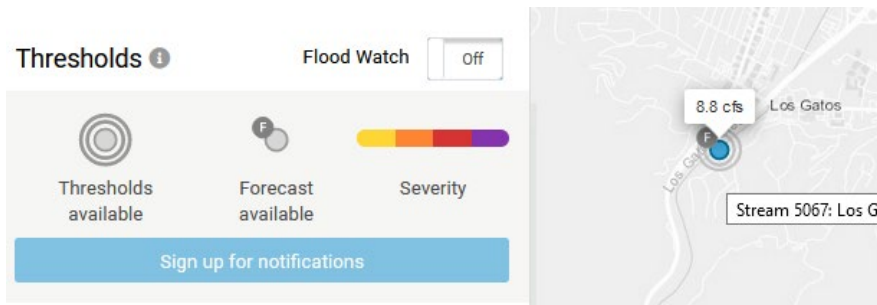
Early in the project we will work with Monterey stakeholders and outline the ideal user experience. Then we will present MPWMD with screen mockups for both mobile and desktop screens, followed by a round of revisions. Once the final designs are approved, we will develop the interface.

## Map Iconography

We create custom map icons using a technology called *scalar vector graphics* (SVG). This allows the map to dynamically convey pieces of information by combining color, icon size, movement, labels, or other indicators. This is a subtle but very effective way of informing users with more data on the map. Most other web map platforms don't do this.

The example below shows an icon presenting multiple pieces of information:

- Color coded by type (blue for stream gauge)
- An attached label shows flow rate or stage for streams, rainfall for rain sensors, and storage or stage for reservoirs based on user selection.
- Hovering on the icon can present a small window with the sensor name and other information.
- Size of icon can illustrate severity, importance, or elevated flow rates
- Presence of pulsating rings indicate flood threshold data available
- Small attached "f" indicated forecast data available



## HOSTING AND SUPPORT

Following development, the website, API, and database need to be hosted on a system with a public facing web server, firewall, bandwidth, and infrastructure suitable for securely hosting online content. The platform will also require some amount of technical support for system administration, backups, monitoring, occasional sensor data feed issues, and minor interface updates. We will provide a system requirements document with specifications for the hosting environment.

Three hosting options:

- MPWMD hosts on their own web server. The agency will need to provide IT support to aid in deployment and the server resources.
- Deploy to a cloud server on MS Azure or Amazon. Costs for this include the monthly cloud server subscription and possibly licensing costs for the database platform. TP or MPWMD can provide the IT resources for cloud deployment.
- Tierra Plan can host the system on our server in our Denver data center. See the attached spec sheet. Our monthly hosting cost is less than a basic cloud server subscription. TP can also provide all IT resources and deployment support.

Regardless of where the system is hosted, we can also provide technical support to address data issues, server management and system administration, support calls, and ad-hoc requests.



## COST ESTIMATE

Our cost estimate is broken down into major system components and includes hours.

We included an optional travel budget if an onsite kickoff meeting is desired. Actual travel costs would be invoiced as expenses. The hosting and support are separate items, and that estimate is per year starting the month the final application is deployed and "goes live".

We are flexible and able to negotiate terms and refine the scope and costs as needed.

Activity	Task	Details	Hours	Cost
<b>Data Activities</b>	Hydstra Data Integration/ETL	Explore and implement the best strategy for extracting data from Hydstra: pulling real time 15- minute data, and extracting historic data per sensor either one-time or on-demand	8	\$1,000
<b>Data Activities</b>	Database and Data Collection	Develop simple relational SQL database model for storing sensor data at 15-minute, hourly, daily, and ytd aggregates. Includes tables, views, sql procedures, documentation and database diagram. Task also includes acquiring spatial data (boundaries, gage points, etc.) and preparing it for web.	10	\$1,250
<b>Data Activities</b>	ETL Console Application	Develop lightweight server-side console application that imports and processes Hydstra data on scheduled tasks.	16	\$2,000
<b>Web API</b>		REST Web API for securely handing all water data requests between web interfaces (maps, charts, downloads, etc.) and backend database and Hydstra.  API includes a web interface for large data downloads per sensor and date range at 15 minute or daily levels.	20	\$2,500
<b>Interface Design</b>		Interface design and user experience, implement Monterey styles and branding.  River health dashboard design and screen mockups with 2 rounds of revision. Define user workflow, graphic elements, HTML and CSS stylesheets, and mobile device responsiveness.	24	\$2,640





<b>Interface Programming</b>	Maps, charts, dashboard	Tasks include customizing and configuring our water portal platform for Monterey data, sensors, and styling. Development of the Carmel river dashboard.	52	\$6,500
<b>Interface Programming</b>	Administrator Interface	Configure simple password protected administrator interface for editing Monterey sensor meta data, uploading sensor photos, and all application configurations.	8	\$1,000
<b>Interface Programming</b>	Testing	Testing processes include 1) unit testing each component at Tierra Plan, 2) acceptance testing collaboration with MPWMD staff. Fixes for testing findings.	12	\$1,500
<b>Deployment Support &amp; Final Deliverables</b>		Admin and staff training sessions (remote). Create admin/technical system documentation.	10	\$1,100
<b>Project Coordination</b>		Project coordination and kickoff, regular progress reviews, project management.	24	\$2,640
	<b>Core Requirements Subtotal</b>		<b>184</b>	<b>\$22,130</b>
<b>Travel (optional)</b>	Site Visit Travel	Estimated air travel and two nights lodging for Kevin Knapp for site visit. Actual travel costs are invoiced as expenses.		\$1,000
	Site Visit onsite time	Two person-days onsite (Kevin Knapp, Sarah Mattern).	16	\$1,600
	<b>Site Visits Subtotal</b>			<b>\$2,600</b>
<b>Hosting, Support, Maintenance</b>	Water Portal Maintenance and Support (annual)	Includes two hours per month for support change requests, ad-hoc issues. Term begins the first month of public "production" deployment.		\$3,000
	System Hosting (annual)	Host the database, web API, website, admin website. Includes server, system administration, backups, firewall, networking, and bandwidth in our Tier 3 data center.		\$3,600
				<b>\$6,600</b>
	<b>Grand Total</b>	"Not to exceed" total.		<b>\$27,730</b>



## Company Background & Experience

### TIERRA PLAN, LLC CORPORATE QUALIFICATIONS

Office Address

13 S Tejon Street, Ste. 301  
Colorado Springs, CO 80903 USA

Mailing Address

PO Box 1462  
Colorado Springs, CO 80901 USA

DUNS Number: 027078507

NAICS Codes (2012): 541430, 541370,

541360, 541512, 541511, 519130

Cage Code: 7LJE1

EIN Number: 45-3652489

Registered in System for Award  
Management (SAM)

Colorado DOT Disadvantaged Business  
Enterprise (DBE)

Key Project Contact

Kevin Knapp - President, Project Lead and  
Authorized Executive

Direct Phone: 719-635-1389

Mobile Phone: 719-332-2058

Email: [kknapp@tierraplan.com](mailto:kknapp@tierraplan.com)

Tierra Plan is an LLC in Colorado, founded in 2009 and is in good financial health and Good Standing with the State of Colorado. Tierra Plan carries a general liability insurance policy up to \$2,000,000, plus professional liability and workers comp coverage.

Tierra Plan is not involved in any pending litigation, liens, or claims and we have never filed for bankruptcy. We have never defaulted on a contract or had a contract terminated.



## Firm Qualifications, Expertise & Experience

**Tierra Plan provides custom GIS solutions focused on data-driven web maps.** We help government agencies answer questions and solve problems by seeing their data in ways that are quickly understood and easily shared—on a map. Our specialties include responsive web interface design and development, data integration, Esri and open-source map platform implementation, geodatabase development, system architecture, and advanced spatial analysis.

Our staff consists of a select group of experts in advanced web development, database development, GIS, spatial analysis, and user interface design. We design and build web GIS interfaces, enterprise database systems, and data APIs, and geographic business intelligence. Tierra Plan is an Esri business partner, specialized in implementing GIS solutions using the Esri platforms and APIs. We also leverage mapping technologies from Leaflet, MapBox, and Google, and native database spatial technologies such as those in SQL Server, Oracle, and MySQL into hybrid solutions that best meets the needs of each project.

Our technical specialties include:

- Custom web map application development
- Web interface design and development
- Web API development
- Database design and data integrations
- GIS architecture and enterprise implementation
- Esri platform implementation including ArcGIS Server, Online, & Portal
- Spatial analysis and modeling



## **MAINTENANCE/WARRANTY**

All deliverables including the website, data API, map services, and data will be delivered free of major defects. Tierra Plan will produce fixes and patches to remedy defects in the software not found during user testing for the first 60 days. During this period, we will maintain a copy of the application platform on our staging and development environment to address any potential issues. In the event MPWMD finds a bug or defect in a tool we will fix it no cost. Tierra Plan will provide e-mail and telephone support for MPWMD staff during its normal business hours Monday through Friday (U.S. holidays excepted). The primary vehicle for support requests will our online ticketing system and e-mail. A bug is defined as defect in the application suite that does not work or returns an error. Changes in scope, new requirements, and enhancements to interfaces or data are not considered bugs or defects.

## **PAYMENT TERMS**

We typically invoice at the end of each month for work performed that month. Invoices are due 30 days after the billing date. Payment details for wire transfer and remittance by mail will be included on each invoice.



## Tierra Plan Hosting Capabilities

We can provide hosting services for any components of a geospatial application in our private cloud. We specialize in hosting and managing geospatial web applications and data. Our servers are collocated in a Tier 3 datacenter in Denver, CO with multiple levels of redundancy and security. Our environment is over-provisioned and highly scalable, so we can easily provide all the servers, software, and storage required for any part of your platform.

We maintain VMware High Availability (HA) server clusters with redundant network storage arrays and two redundant Barracuda firewalls. We can also provide dedicated server(s) and secure VPN access for your project team if needed

Hosting agreements include technical support and system administration, data backup and recovery strategies, bandwidth, and high availability (HA) servers with failover, ensuring your data is safe and can be recovered to any point in time.

### Data center specifications

- 12 internet carrier connection redundancy
- ISO 27001 Compliant
- SOC 2 Type II & SOC 3
- HIPAA Compliant
- PCI Compliant
- High Availability VMware server clusters, and multiple levels of redundant hardware, firewalls, and switches.
- N+1 Backup Power
- N+1 designed climate control
- High-density redundant cooling systems
- 24x7 monitoring and security
- Multi-level access authorization with mantrap, biometric verification and security-controlled access level assignment