

COVID-19 Water and Sanitation

Hackathon



WRC Covid19 Water and Sanitation Hackathon

The Resources

10 - 11 July 2020, Virtually

CHALLENGE 1: The first challenge will involve solving a COVID-19 water and sanitation challenge using machine learning and data science.

CHALLENGE 2: The second challenge requires the use of technology to enhance communication and drive behaviour change.

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#WRCHack4Water



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1) Open Datasets

SANITATION SERVICES

Statistics South Africa collects data on the availability of sanitation at household level in different municipalities. This is done through:

- **Citizen reporting via Census 2011, Community Survey (CS) 2016 and General Household Surveys (GHS).** Access Census and CS data on Wazimap: <https://wazimap.co.za/profiles/province-GT-gauteng/> and PDF reports for GHS http://www.statssa.gov.za/?page_id=1866&PPN=P0318&SCH=7652 or source data on SuperWEB2 <http://superweb.statssa.gov.za/webapi/jsf/login.xhtml>
- **Municipal reporting on the provision of services through the Non-financial Census of Municipalities.** See Table 8 for water supply and Table 9 for toilet facilities. Download summary PDF as well as the XLSX 'unit data' from 2005 to 2018: http://www.statssa.gov.za/?page_id=1866&PPN=P9115&SCH=7628

Gauteng City Region Observatory (GCRO) Quality of Life Survey collects details on water and sanitation in the Province. Download from UCT Datafirst platform <https://www.datafirst.uct.ac.za/dataportal/index.php/catalog/766/study-description>. Also read how GCRO is applying this data to understand COVID-19 vulnerability: <https://www.gcro.ac.za/research/project/detail/responding-covid-19-pandemic-gauteng/>

ISMaps <http://ismaps.org.za/desktop.html#> shows how 2015 data from City of Cape Town was used to map the type of toilets available to residents of informal settlements <https://data.openup.org.za/dataset/toilets-in-cape-town-s-informal-settlements-abad-taj3>

Asivikelani project is collecting citizen reporting on access to water, clean toilets and waste removal in informal settlements during COVID-19. May be downloaded as XLS. <https://www.internationalbudget.org/covid-monitoring/>

Check-IT for example crowd-sourcing of data on toilet and tap operation, starting in Khayelitsha <http://checkit.org.za/views/map>



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DEPARTMENT OF WATER & SANITATION (DWS) INFORMATION SYSTEMS

The DWS provides access to many datasets via a central National Integrated Water Information System (NIWIS) <http://www.dwa.gov.za/niwis2/>. The various dashboards allow you to download a CSV or EXCEL file, some have historical data. For example:

Drinking-Water Quality Compliance: <http://www.dwa.gov.za/niwis2/dwq2>

- Use the "Filter Options" button to select data from 2016 to 2020
- Click on the Province + to expand provincial data to municipal level
- Download the CSV file
- Note that the data is presented as a %: the total number of samples taken over the period/ number of failed samples (hover your mouse over the cell to see values). So to analyse trends over time, you will need to select smaller time periods (e.g. month or year) then download these individually.
- You can access additional water quality-related data via Resource Quality Information Services (RQIS) pages <http://www.dwa.gov.za/iwqs/default.aspx>

Water Supply Reliability: only shows the latest data, but can expand down to a municipal level by clicking on Province + and compare municipalities
<http://www.dwa.gov.za/niwis2/WaterSupplyReliability>

Groundwater Quality: access data for 1966 to 2019 for specific monitoring stations around the country (click on the table names)
<http://www.dwa.gov.za/niwis2/GroundwaterQuality>.

Surface Water Storage (e.g. dam levels): can select data for the past 5 years (click below the graph), down to specific dams (click on the table names)
<http://www.dwa.gov.za/niwis2/SurfaceWaterStorage>

Raw water tariffs (e.g. for irrigation vs. domestic vs. forestry) can select data from 2016 to 2019 (use the "Filter Options" button), down to specific water management areas around the country (click on the table names)
www.dwa.gov.za/niwis2/RWT. Also access more detailed and older charge data from the WARMS page. For example, 2020/21:
<http://www.dwa.gov.za/Projects/WARMS/Revenue/charges2020.aspx>



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Spatial data on water resources: can be accessed from RQIS. Includes the location and boundaries for drainage regions, water management areas, rivers, dams, lakes and lagoons. Most data is available as KMZ file type which can be converted to GeoJSON or similar using an online tool like <https://geoconverter.hsr.ch/>. Then you can visualise them in an online tool like Kepler <https://kepler.gl/> or download and install QGIS. <http://www.dwa.gov.za/iwqs/wms/data/000key2data.asp>

DAFF PORTAL

The previous Department of Agriculture, Forestry and Fisheries (DAFF) - with the agriculture component now part of the Department of Agriculture, Land Reform and Rural Development (DALRRD) - operates a portal with various maps and datasets related to water availability and use.

<http://daffarcgis.nda.agric.za/portal/home/index.html>

Most of the water-related data on the DAFF portal is provided in Shapefiles (SHP) (instead of the KMZ files from the DWS RQIS). As with the KMZ files you can convert SHP files to another open format such as GeoJSON using <https://mapshaper.org/> or <https://geoconverter.hsr.ch/>, or download and install QGIS.

Some examples from the DAFF portal include:

Temperature Avg long-term annual (2001, SHP file):

<http://daffarcgis.nda.agric.za/portal/home/item.html?id=272dff3d8e1a4cd08e6edef4831c4eb4>

Rainfall - mean annual (? , SHP file):

<http://daffarcgis.nda.agric.za/portal/home/item.html?id=e0f409a9142a4abaaf45d904744cc037>

Rivers (? , SHP file):

<http://daffarcgis.nda.agric.za/portal/home/item.html?id=6497eab0994a49bca63226102b0d7058>

Dams (? , SHP file):

<http://daffarcgis.nda.agric.za/portal/home/item.html?id=7ca63e99315943baaa56697ec35f8415>



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WATER PERMITS

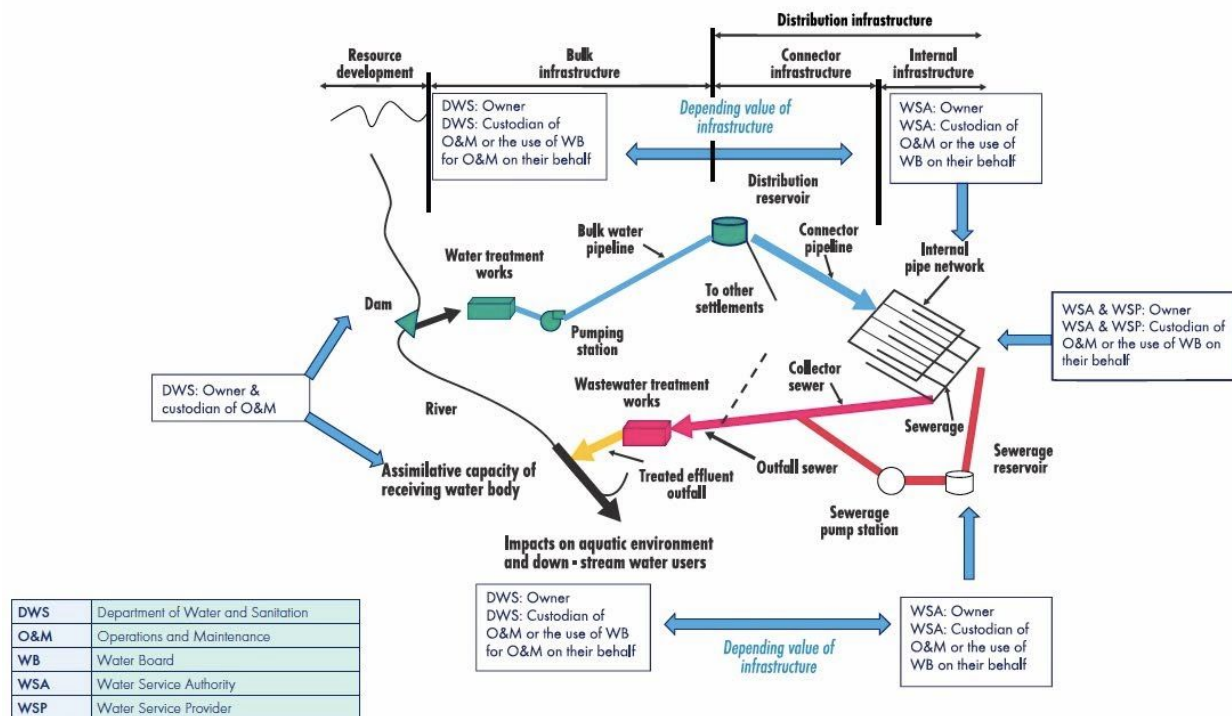
Water permit data via Oxpeckers <https://oxpeckers.org/get-the-data/>

AG REPORT: WATER INFRASTRUCTURE PERFORMANCE AUDIT

The AG report identifies a number of challenges faced in the procurement and management and water infrastructure. And provides a useful overview of the water and sanitation value chain.

<http://www.agsa.co.za/Portals/0/Downloads/Water%20Infrastructure%20and%20Public%20Report.pdf>

Water and sanitation value chain





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WATER RESOURCES OF SOUTH AFRICA, 2012 STUDY (WR2012) DATA

Extensive source of data on "GIS maps, WRSM2000 (Pitman) rainfall-runoff model, WR2005 database, Reports, Quaternary data spreadsheets, Patched observed streamflow data, Catchment rainfall groups, Catchment based rainfall, Point rainfall, Naturalised streamflow, Water quality, Monitoring, Land/water use, Present day streamflow and Reservoir records." Free registration to download the data.
<http://waterresourceswr2012.co.za/>

DRDLR SOUTH AFRICAN SPATIAL DATA INFRASTRUCTURE (SASDI)

The previous Department of Rural Development and Land Reform (DRDLR) - now Department of Agriculture, Land Reform and Rural Development (DALRRD) - host the SASDI portal which provides various water-related datasets
<http://www.sasdi.net/search.aspx>. As many of these are spatial datasets in SHP file format, you will need to convert and use them as noted above.

GLOBAL WATER DATABASES

The Global Terrestrial Network - Hydrology provides a useful list of major water-related data sources: <http://www.gtn-h.info/about/the-network/>. This is useful for comparing South Africa to other countries, and over multiple years. Two examples:

The FAO AQUASTAT "core database provides the platform for organizing and presenting over 180 variables and indicators on water resources and their use which include water withdrawal, wastewater, pressure on water resources, irrigation and drainage, and few components on environment and health. They can be searched and extracted, along with their metadata, for 200+ countries and for different regions over an extensive-time period (from 1960 to 2017)":

<http://www.fao.org/aquastat/en/databases/maindatabase/>

<http://www.fao.org/nr/water/aquastat/data/query/index.html?lang=en>

The GEMStat which allows you to "access GEMStat water quality data and to produce a statistical and graphical analysis of water quality data at station, country or catchment level." <https://gemstat.org/data/data-portal/>
<https://gemstat.bafg.de/applications/public.html?publicuser=PublicUser#gemstat/Stations>



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SOUTH AFRICAN WEATHER DATA

The South African Weather Services (SAWS) hosts a number of data products, most of which are not free or open access. <http://www.weathersa.co.za/>

However, there is a pilot access to their data API which you can try - and decide if you would like to purchase a commercial subscription.

AfriGIS Weather API: "exposes the South African Weather Service (SAWS) data feeds as an Application Programming Interface (API). The API includes measurements, forecasts, thunderstorms, lightning and weather alerts"

The pilot access to API includes "fifty (50) credits per day, for a maximum of sixty (60) days" <https://developers.afrigis.co.za/portfolio/weather-api/>. Try this demo API GET to see what type of data is available:

https://saas.afrigis.co.za/rest/2/weather.measurements.getByCoord/myapisamples/bBFMNngfUSqQ80kFWUwmihszdPs/?location=-25.808589,28.255833&location_buffer=10000&station_count=3

The South African Air Quality Information System (SAAQIS) also records temperature, humidity, wind and rainfall from its various monitoring sites around the country. This data can be downloaded as EXCEL file. <http://saaqis.environment.gov.za/>

GLOBAL AND SOUTH AFRICA CLIMATE DATA FROM NOAA

US NOAA Climate Data Online including daily summaries for various South African sites, download in CSV format

<https://www.ncdc.noaa.gov/cdo-web/datasets/GHCND/locations/FIPS:SF/detail>



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DEA E-GIS

South Africa's Environmental Geographical Information Systems (E-GIS) webpage includes downloads for various environmental datasets.

<https://egis.environment.gov.za/>

OCIMS

National Oceans and Coastal Information Management System (OCIMS)

<https://www.ocims.gov.za/>

SANBI BIODIVERSITY GIS

SANBI provides spatial datasets on various biodiversity themes, many of which are related to water availability and use - such as wetland locations and boundaries.

<http://bgis.sanbi.org/SpatialDataset>.

miniSASS

"The most important feature of the new website is the miniSASS Map, which allows you to explore your catchment, find your river, look at any existing miniSASS results and then upload your own miniSASS results! The map also lets you explore your catchment to see the land uses and activities that might be improving or worsening water quality." <http://www.minisass.org/en/map/>



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2) HERE Maps Tools

Sign up via: HERE Developer portal and API's using this link **ONLY**: <https://t.her.is/WESA>

(**REMEMBER**: all APIs have corresponding documentation and sample code that you can **COPY & PASTE** for free; **31 APIs AVAILABLE**).

When logged in, all API information is under the documentation tab:

1. Location Services-Maps

Interactive Maps (JS):

<https://developer.here.com/documentation/maps/topics/quick-start.html>

2. Location Services-Routing

Routing (JS): <https://developer.here.com/documentation/maps/topics/routing.html>

3. Fleet Telematics- Route Matching:

<https://developer.here.com/documentation/route-match/topics/quick-start-gps-trace-route.html>

4. How to get the location of a user in a web browser and reverse geocode that location to an address using HERE and JavaScript & HTML5

<https://www.youtube.com/watch?v=iKWpK66Scyk&list=PLTlZUhyLwZTdEuOjcKeRh-Zj4ky6jpC9M&index=6>

5. Developer Resources (Tutorials):

- a. Using a Raspberry pie to add location, Real time maps.

<https://developer.here.com/blog/real-time-maps-with-a-raspberry-pi-golang-and-here-xyz>



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- b. Publish Location data from a Raspberry Pi and view it on a map.
<https://developer.here.com/blog/publish-location-data-from-a-raspberry-pi-to-here-xyz-and-view-it-on-a-map>
- c. How to use HERE location Services Routing to navigate features in an XYZ space
<https://developer.here.com/tutorials/xyz-hls/>
- d. How to reverse geocode addresses with HERE in Kotlin (designing map gesture events):
<https://developer.here.com/blog/designing-map-gesture-events-in-kotlin-and-android-to-reverse-geocode-addresses-with-here>
- e. How to reverse geocode addresses with HERE in Kotlin:
<https://developer.here.com/blog/geocoding-addresses-with-kotlin-and-here-in-android>
- f. Gathering the Android Device Position with the HERE positioning API:
<https://developer.here.com/blog/gathering-the-android-device-position-with-the-here-positioning-api>
- g. Adding map markers to your map:
<http://jsfiddle.net/gh/get/jquery/2.1.0/heremaps/maps-api-for-javascript-examples/tree/master/markers-on-the-map>
- h. Calculated time dependent turn by turn navigation including traffic. (Don't forget to set mode traffic to true). <https://github.com/gis-ops/routing-py>

6. HERE GitHub: <https://github.com/heremaps/>

<https://github.com/kuberaspeakin>

100 days of code with HERE: <https://github.com/kuberaspeaking/100DaysOfCodeWithHERE>

Food Delivery with HERE: <https://github.com/kuberaspeaking/FoodDeliveryWithHERE>

7. HERE Slack Channel: <https://heredev.slack.com/?redir=%2Fgantry%2Fclient>

This video will give you great insight into 3 API use cases):

<https://go.engage.here.com/Webinar-Startup-Map-and-Location-API-On-Demand.html>



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8. HERE Developer YouTube Channel:

https://www.youtube.com/watch?v=nD_NILYDmk8&list=PLTIZUhyLwZTcr5kukSrWjkwM0WDOUsA5

HERE XYZ: Map Visualization

Please login to HERE XYZ using the same credentials you've used to access Mapcreator or the APIs. HERE XYZ enables you to build your own maps for free and visualize them in a way that suits you.

1. HERE XYZ link: <https://xyz.here.com/>
2. HERE XYZ Token Creation Page: <https://xyz.api.here.com/token-ui/login.html>
3. HERE XYZ studio Documentation: <https://www.here.xyz/studio/>
4. HERE XYZ Tutorials: <https://developer.here.com/tutorials?category=HERE%2BXYZ>
5. HERE XYZ API (HERE XYZ Playground):

https://xyz.api.here.com/maps/latest/playground/index.html#display_Hello%20World



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How to link you XYZ data to HERE location services:

1. <https://github.com/heremaps/xyz-qgis-plugin/blob/master/README.md>

Code example of how to find latitude and longitude of current location:

```
<html>

<head>

<meta name="viewport" content="initial-scale=1.0, width=device-width" />

<link rel="stylesheet" type="text/css" href="https://js.api.here.com/v3/3.1/mapsjs-ui.css" />

<script src="https://js.api.here.com/v3/3.1/mapsjs-core.js"

type="text/javascript" charset="utf-8"></script>

<script src="https://js.api.here.com/v3/3.1/mapsjs-service.js"

type="text/javascript" charset="utf-8"></script>

<script src="https://js.api.here.com/v3/3.1/mapsjs-ui.js"

type="text/javascript" charset="utf-8"></script>

<script src="https://js.api.here.com/v3/3.1/mapsjs-mapevents.js"

type="text/javascript" charset="utf-8"></script>

</head>

<body>

Clint's First Map
```



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```
<button onclick="getLocation()">LocateMe</button>

<div style="width: 100vw; height: 100vh" id="mapContainer"></div>

<script>

  function getLocation() {

if (navigator.geolocation) {

navigator.geolocation.getCurrentPosition(showPosition);

} else {

myCurrentLocation = "Geolocation is not supported by this browser.";

}

}

function showPosition(position) {

var myCurrentLocation = "Latitude: " + position.coords.latitude +

"<br>Longitude: " + position.coords.longitude;

alert (myCurrentLocation);

}

// Initialize the platform object:

var platform = new H.service.Platform({
```



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```
'apikey': 'mn8qEiLX-laG9ZHW8vg'

});

// if(navigator.geolocation) {

//   navigator.geolocation.getCurrentPosition(position => {

//     var map = new H.Map(

//       document.getElementById("map"),

//       platform.createDefaultLayers().normal.map,

//       {

//         zoom:13,

//         center: { lng: 28.20, lat: -26.04 }

//       }

//     );

//   });

// Obtain the default map types from the platform object

var maptypes = platform.createDefaultLayers();

// Instantiate (and display) a map object:

var map = new H.Map(

document.getElementById('mapContainer'),
```




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```
maptypes.vector.normal.map,  
  
{  
  
  zoom:13,  
  
  center: { lng: 28.20, lat: -26.04 },  
  
  pixelRatio: window.devicePixelRatio || 1  
  
});  
  
window.addEventListener('resize', () => map.getViewPort().resize());  
  
var berlinMarker = new H.map.Marker({  
  
  lat:-26.0433,  
  
  lng:28.2212  
  
});  
  
map.addObject(berlinMarker);  
  
var berlinMarker = new H.map.Marker({  
  
  lat:-26.0833,  
  
  lng:28.2562  
  
});  
  
map.addObject(berlinMarker);  
  
var behavior = new H.mapevents.Behavior(new H.mapevents.MapEvents(map));
```



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```
var ui = H.ui.UI.createDefault(map, maptypes);  
  
</script>  
  
</body>  
  
</html>
```

3) IoT Tools

- Unashield with Sigfox Network: <https://github.com/UnaBiz>
- Water Level Monitor (Arduino):
<https://create.arduino.cc/projecthub/NewMC/water-level-monitor-b42be9>
- Arduino IDE: <https://www.arduino.cc/en/main/software>

4) Development Tools/IDEs/Editors

Development

- Visual Studio Code: <https://code.visualstudio.com/>
- Mobirise Templates: <https://mobirise.com/bootstrap-template/>
- Hosting: Github Pages, Heroku, Netfly, Digital Ocean

Data Visualization

- Microsoft Power BI: <https://powerbi.microsoft.com/en-us/>
- Google Charts: <https://developers.google.com/chart/>
- ArcGIS Story Mapping: <https://storymaps.arcgis.com/>



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5) Policy, Business-Sense and Design Guidelines

- Water Research Commission: <http://www.wrc.org.za/>
- 20 Minutes of the Business Model Canvas: <https://www.alexandercowan.com/business-model-canvas-templates/>
- Materialize CSS: <https://materializecss.com/>
- Brand Essence: <https://www.brandingstrategyinsider.com/brand-essence>
- Color Palette: <https://colorhunt.co/>

6) Presentations

- Google Slides: <http://slides.google.com>
- Elevator Pitch: <https://www.thebalancecareers.com/elevator-speech-examples-and-writing-tips-2061976>
- PowerPoint Templates: <https://www.slidescarnival.com/category/free-templates>
- Free Photos: <https://unsplash.com>
- Icons, Charts and Flow Diagrams: <https://www.draw.io/>