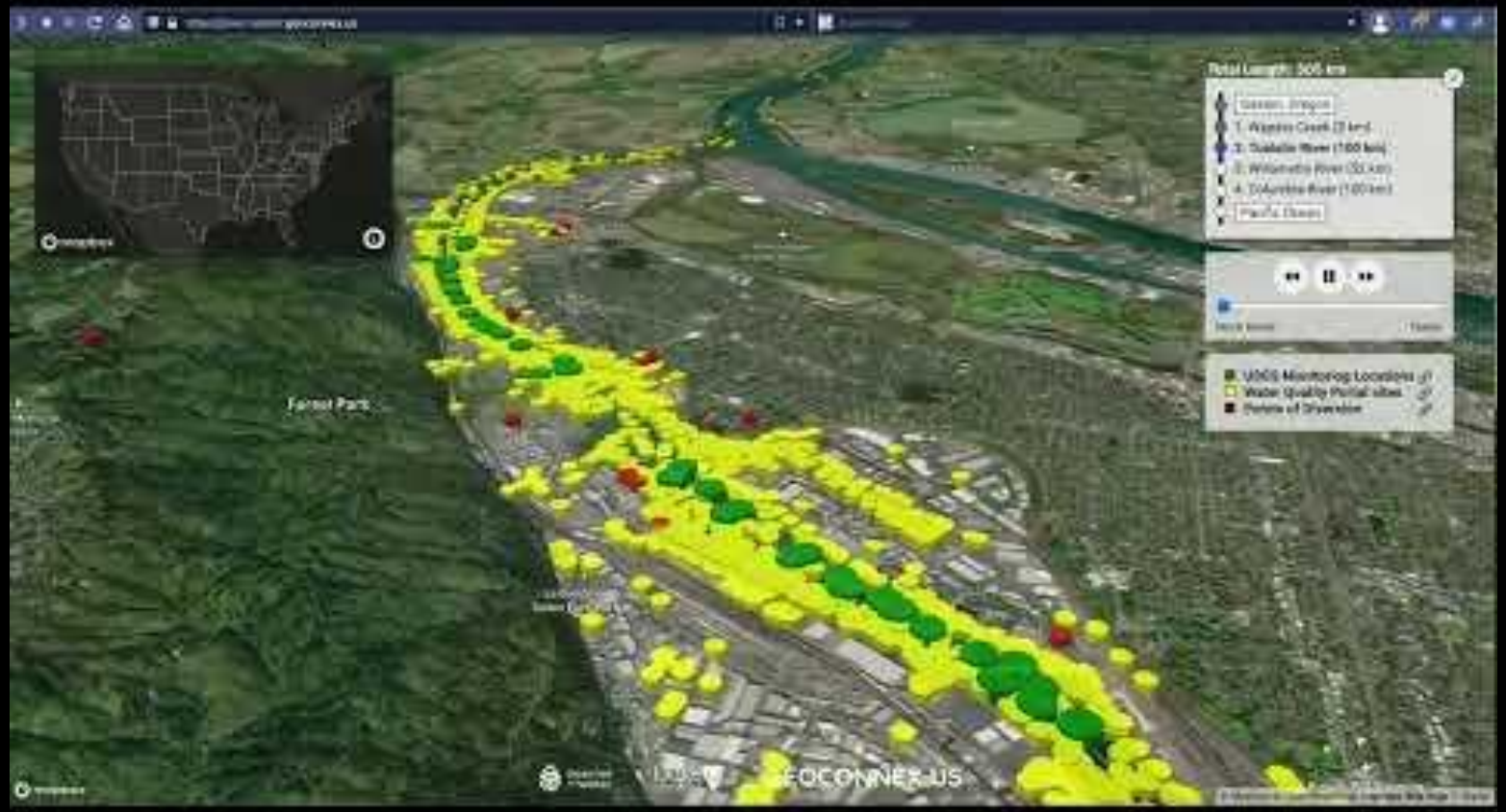
The Internet of Water in New Mexico: geoconnex.us and the NLDI

Internet of Water



river-runner.geoconnex.us

Kyle Onda (konda@lincolninst.edu)
Associate Director, Internet of Water

CENTER FOR GEOSPATIAL SOLUTIONS

LINCOLN INSTITUTE OF LAND POLICY

The Internet of Water: A vision for modern water data infrastructure connecting water data across the US so that it is Discoverable, Accessible, and Interoperable

Internet of Water COALITION

WESTERN STATES WATER COUNCIL

Duke NICHOLAS INSTITUTE FOR ENVIRONMENTAL POLICY SOLUTIONS

CENTER FOR GEOSPATIAL SOLUTIONS
Lincoln Institute of Land Policy

CUAHSI universities allied for water research

Water Data Collaborative

A formal Coalition of organizations providing technology research, development, and socialization enabling the vision

USGS science for a changing world

California Water Boards

Texas Water Development Board

EPA

New Mexico Water Data

WESTERN STATES WATER COUNCIL

Water Data Collaborative

CUAHSI universities allied for water research

CENTER FOR GEOSPATIAL SOLUTIONS
Lincoln Institute of Land Policy

A community of practice implementing the ideas developed in the Coalition, sometimes formalized as projects

GEOCONNEX.US

NLDI

Outline

- What is geoconnex
- What is the NLDI
- Piloting in New Mexico
- Future Work

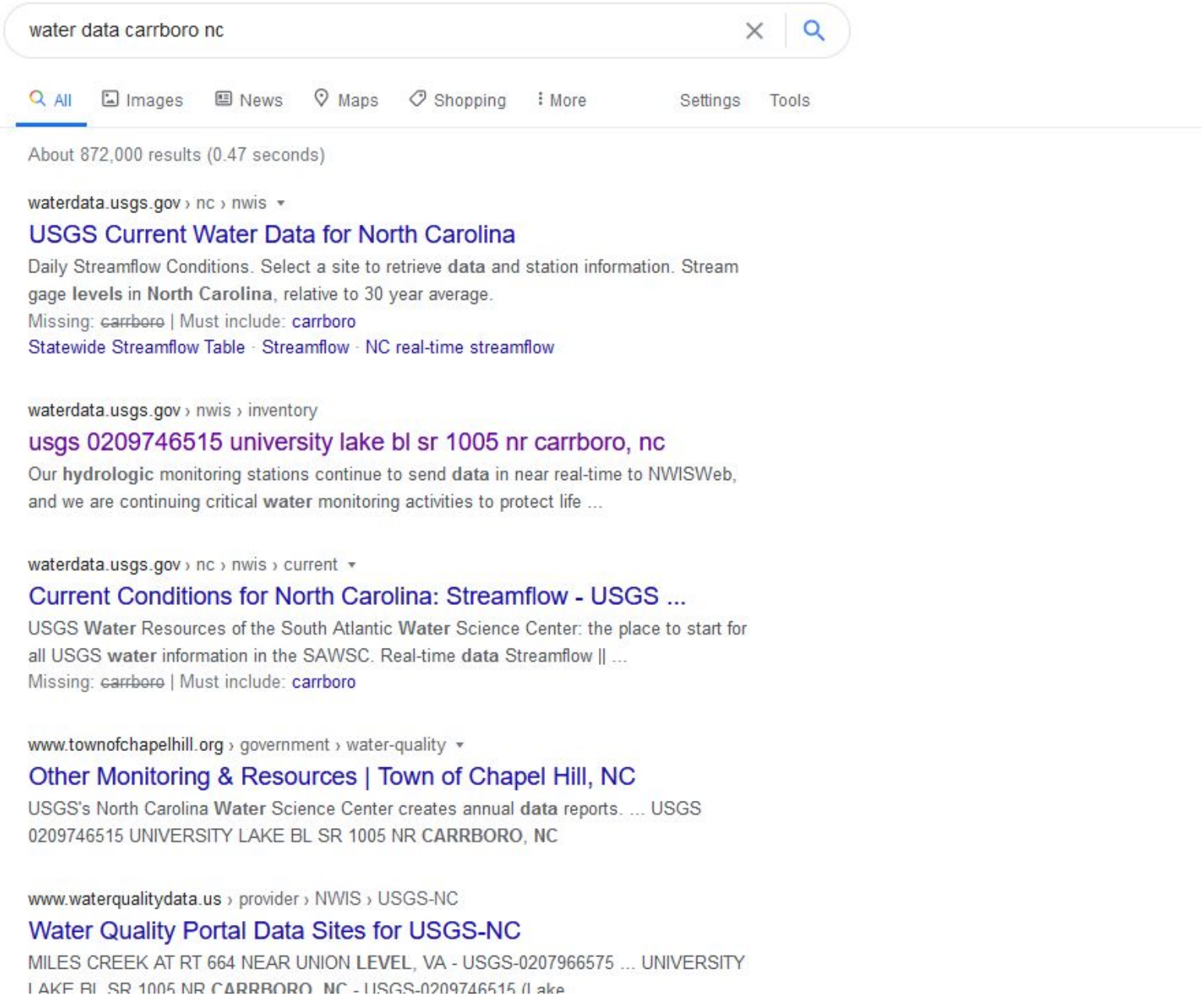
GEOCONNEX.US

Motivations

"As a user of water data, I need to discover and access water information relevant to the environmental feature I care about from all the organizations that hold data about it, so I don't have to have special knowledge to access some information and so I don't miss some potentially relevant information."

Dave Blodgett (USGS)

Second Environmental Linked Features Experiment:
(https://docs.ogc.org/per/20-067.html



Currently…

A mix of structured and unstructured data

Dominated by USGS – administered systems

Dominated by state-wide views

Missing important topics and data providers

Google

Water data carrboro nc

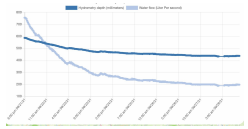
Water data relevant to Carrboro, NC, 27510. Morgan Creek Watershed

Stream-flow	Precip-itation	Water Quality	Drinking Water Quality	Water Use

Streamflow near Carrboro NC

USGS Gages
Morgan Creek
Booker Creek

NC Department of Emergency Mgmt Gages
Station 1234B
Station 45x



Orange Water and Sewer Authority Gages
OWASA University Lake

Haw River Keeper

The Vision

Data that is...

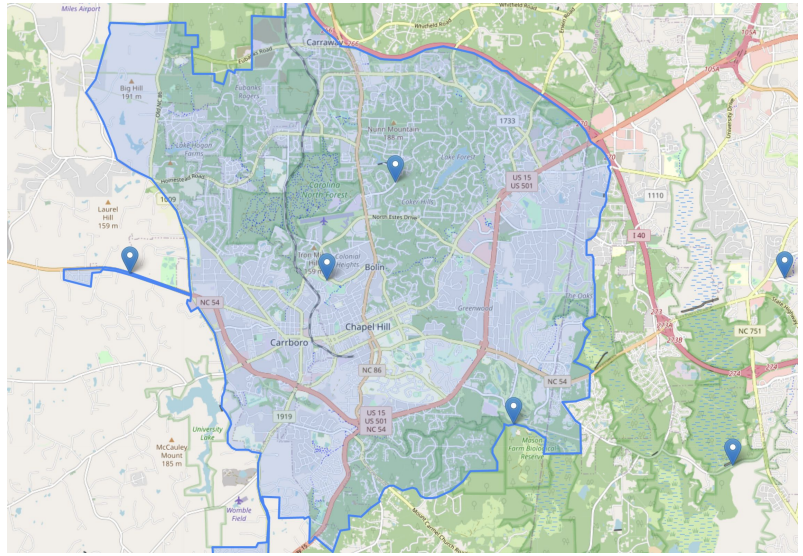
DISCOVERABLE

Spatially - indexed

Topically - organized

Site-level granularity

No prior knowledge of water data providers required



geoconnex.us Community

- Funded By:

Internet of Water COALITION

Duke NICHOLAS INSTITUTE FOR ENVIRONMENTAL POLICY SOLUTIONS

USGS science for a changing world

- Developed by:

CENTER FOR GEOSPATIAL SOLUTIONS

Lincoln Institute of Land Policy

USGS science for a changing world

- Operated by:

CENTER FOR GEOSPATIAL SOLUTIONS

Lincoln Institute of Land Policy

- Data contributed (so far) by:

USGS science for a changing world

Water Data Collaborative

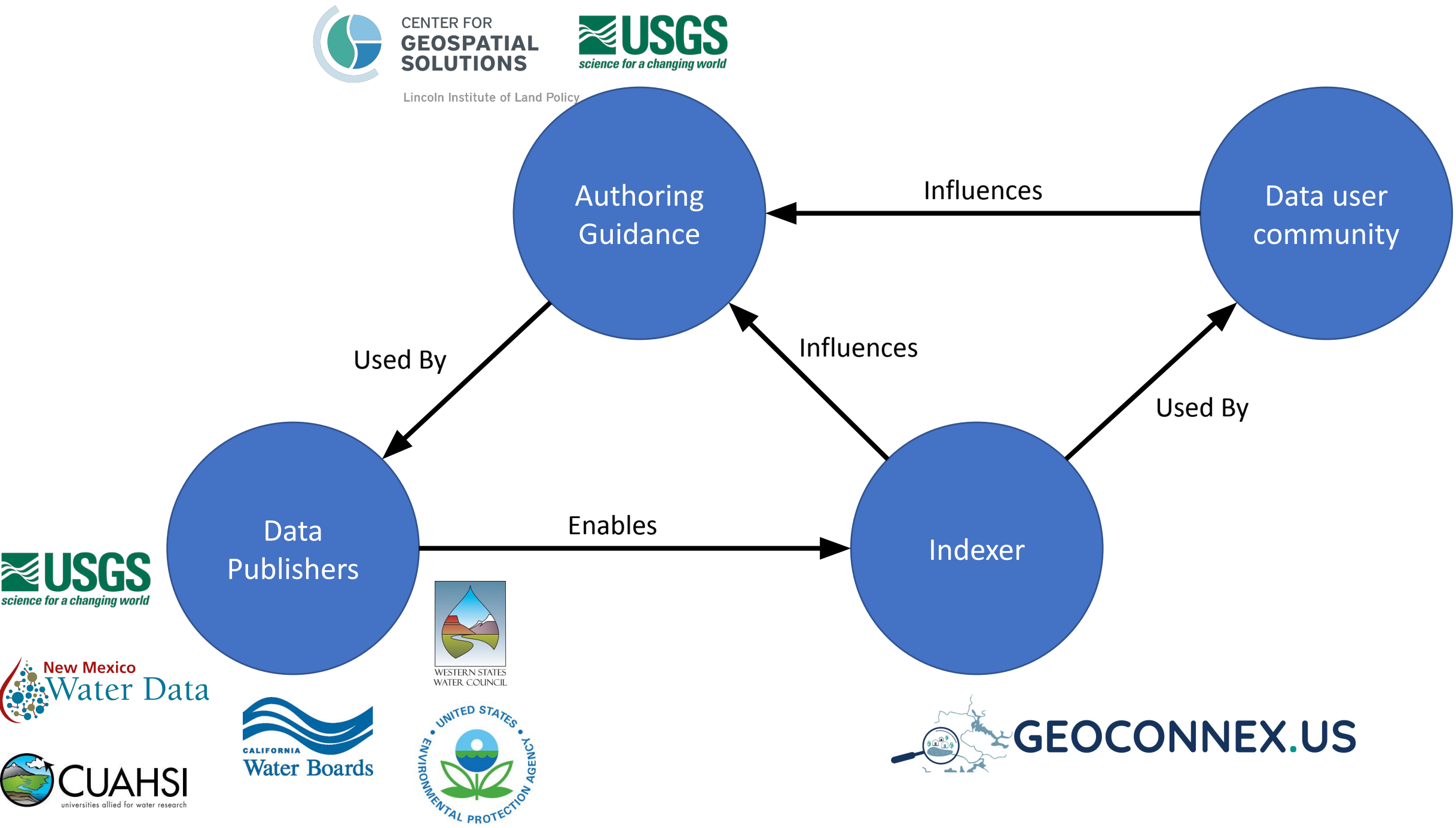
WESTERN STATES WATER COUNCIL

CUAHSI universities allied for water research

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

CALIFORNIA Water Boards

New Mexico Water Data


CENTER FOR GEOSPATIAL SOLUTIONS
Lincoln Institute of Land Policy
USGS science for a changing world
Authoring Guidance
Influences
Data user community
Used By
Influences
Used By
Data Publishers
Enables
Indexer
USGS science for a changing world
WESTERN STATES WATER COUNCIL
New Mexico Water Data
CALIFORNIA Water Boards
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
CUAHSI universities allied for water research
GEOCONNEX.US

Workflow Vision (WaDE example)

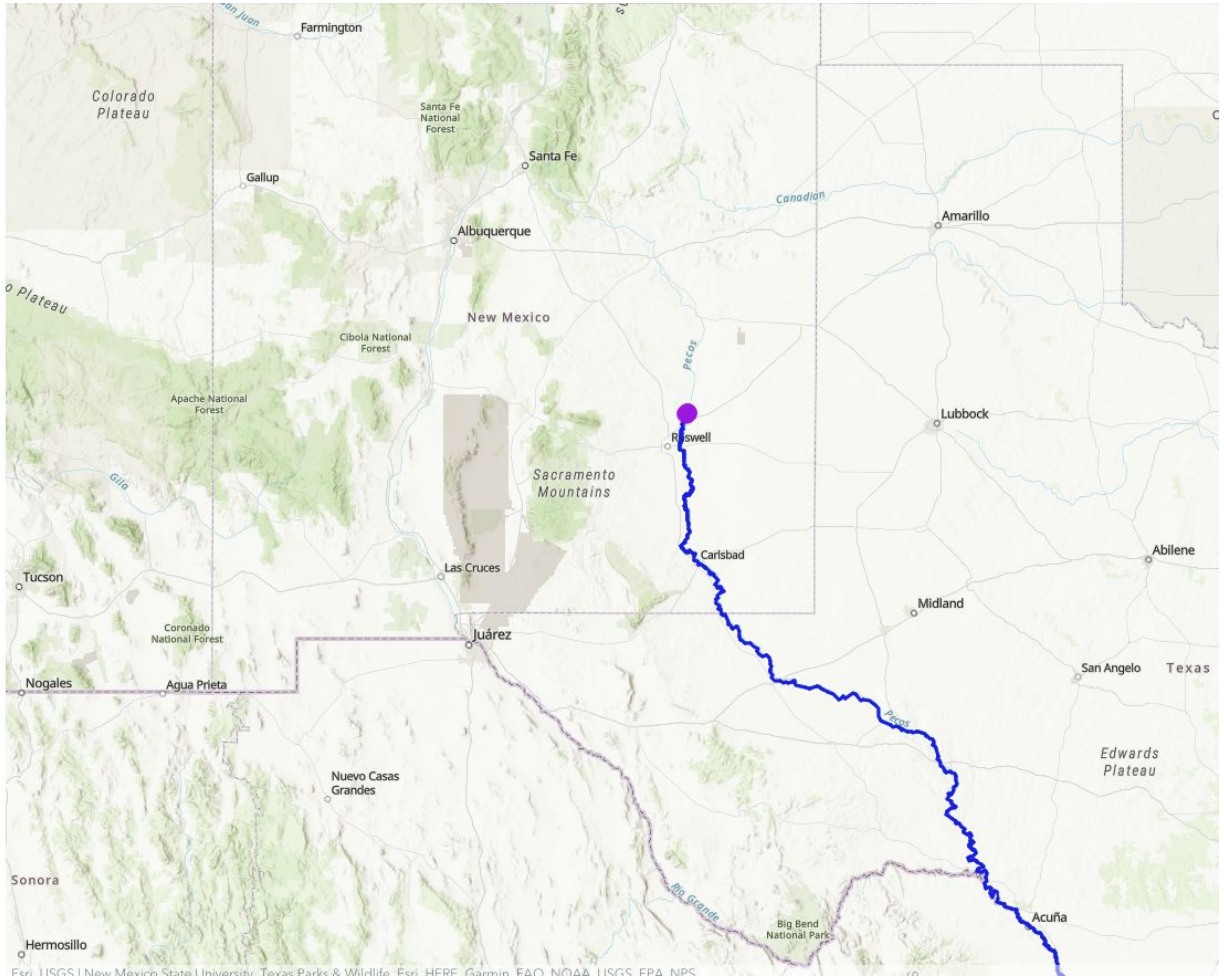
I want **all** real-time, historical, and model/forecast data from hydrologically relevant in the **past 30 days** regarding:

- Precipitation
- Diversion
- Flow/stage
- GW Pumping

WESTERN STATES WATER COUNCIL

Water diversions time series data

Dashboard

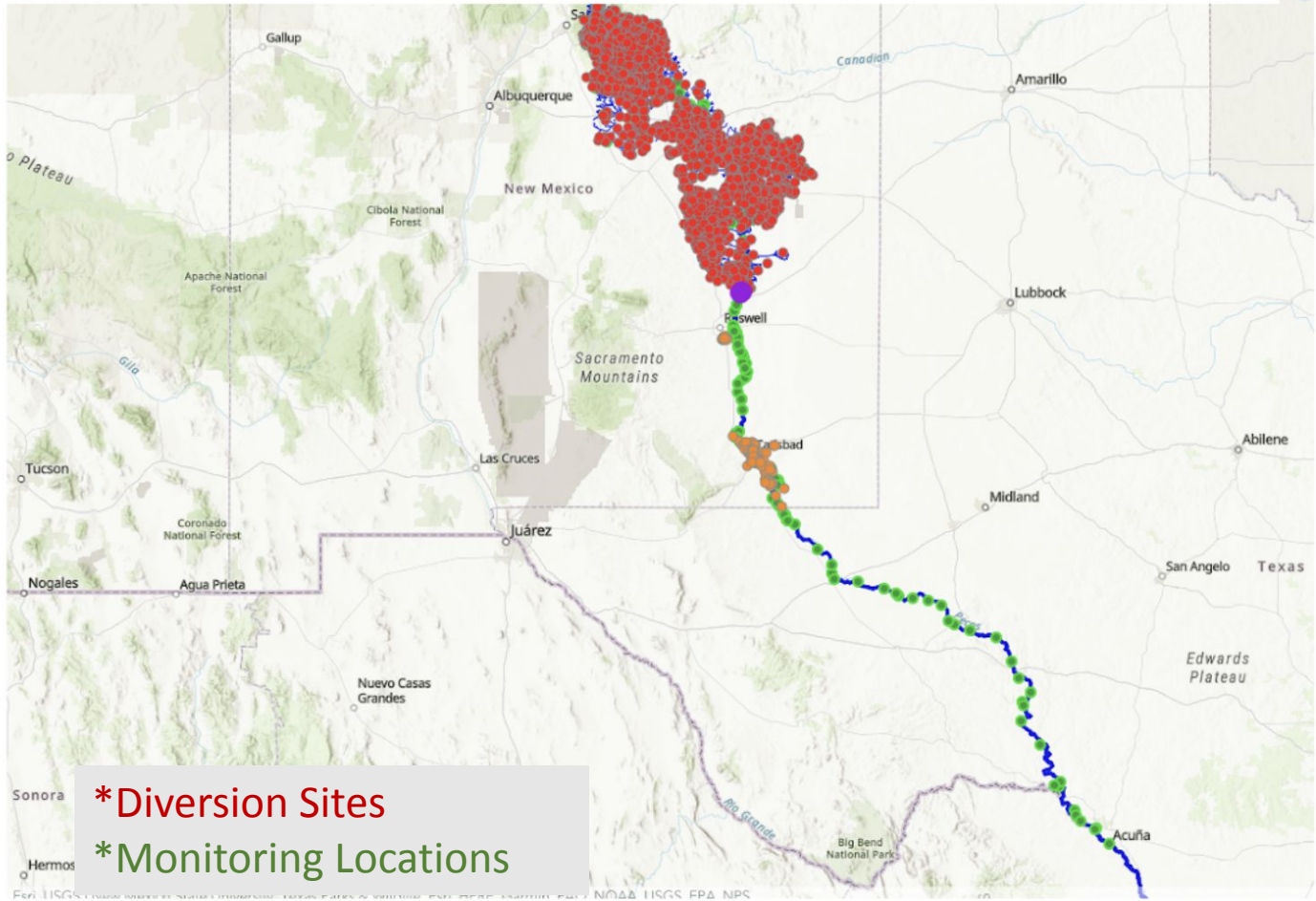


Workflow Vision (WaDE Example)

Network Linked Data Index

WESTERN STATES WATER COUNCIL

Water diversions time series data

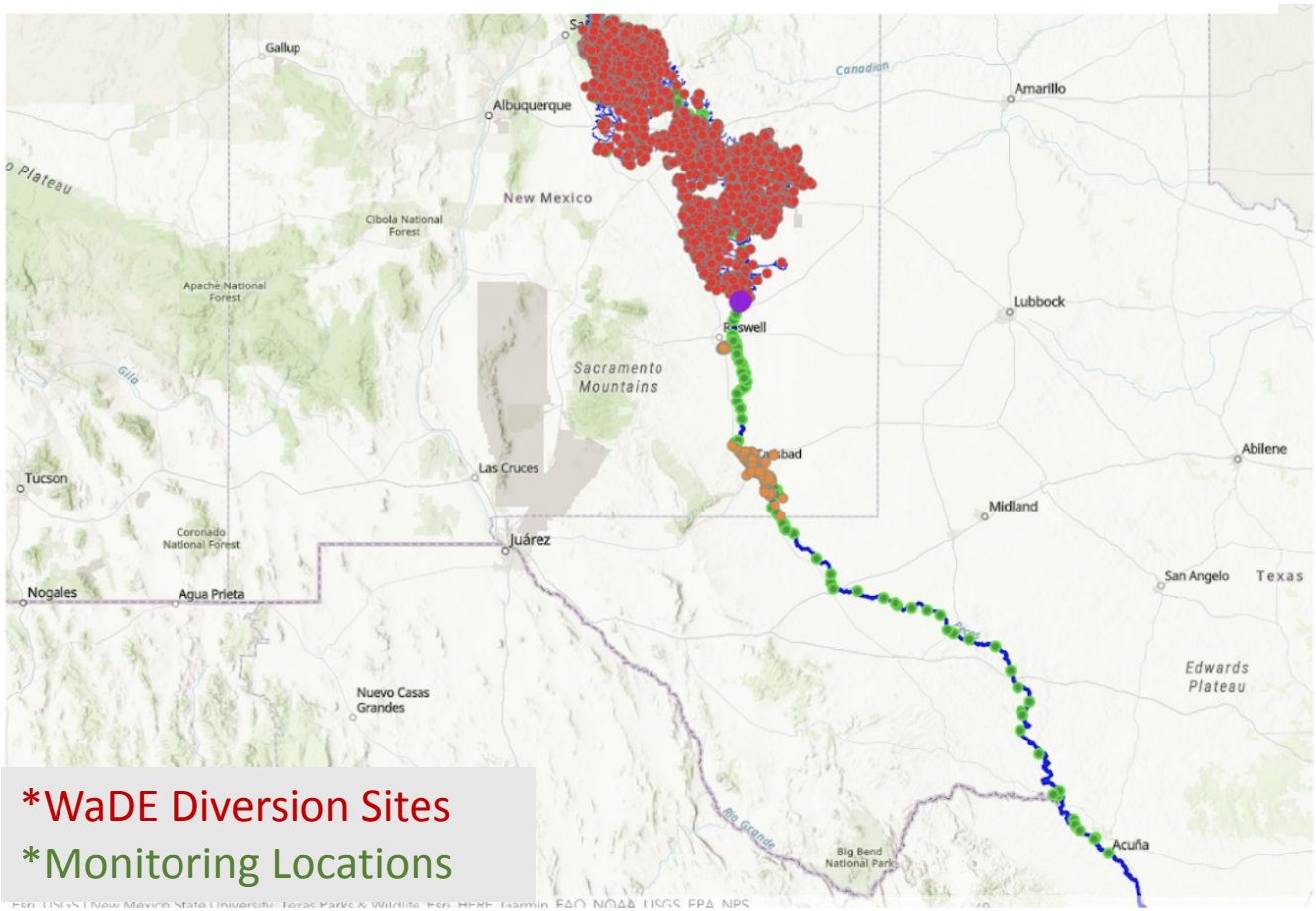


Workflow Vision (Development by WaDE)

Network Linked Data Index

WESTERN STATES WATER COUNCIL

Water diversions time series data



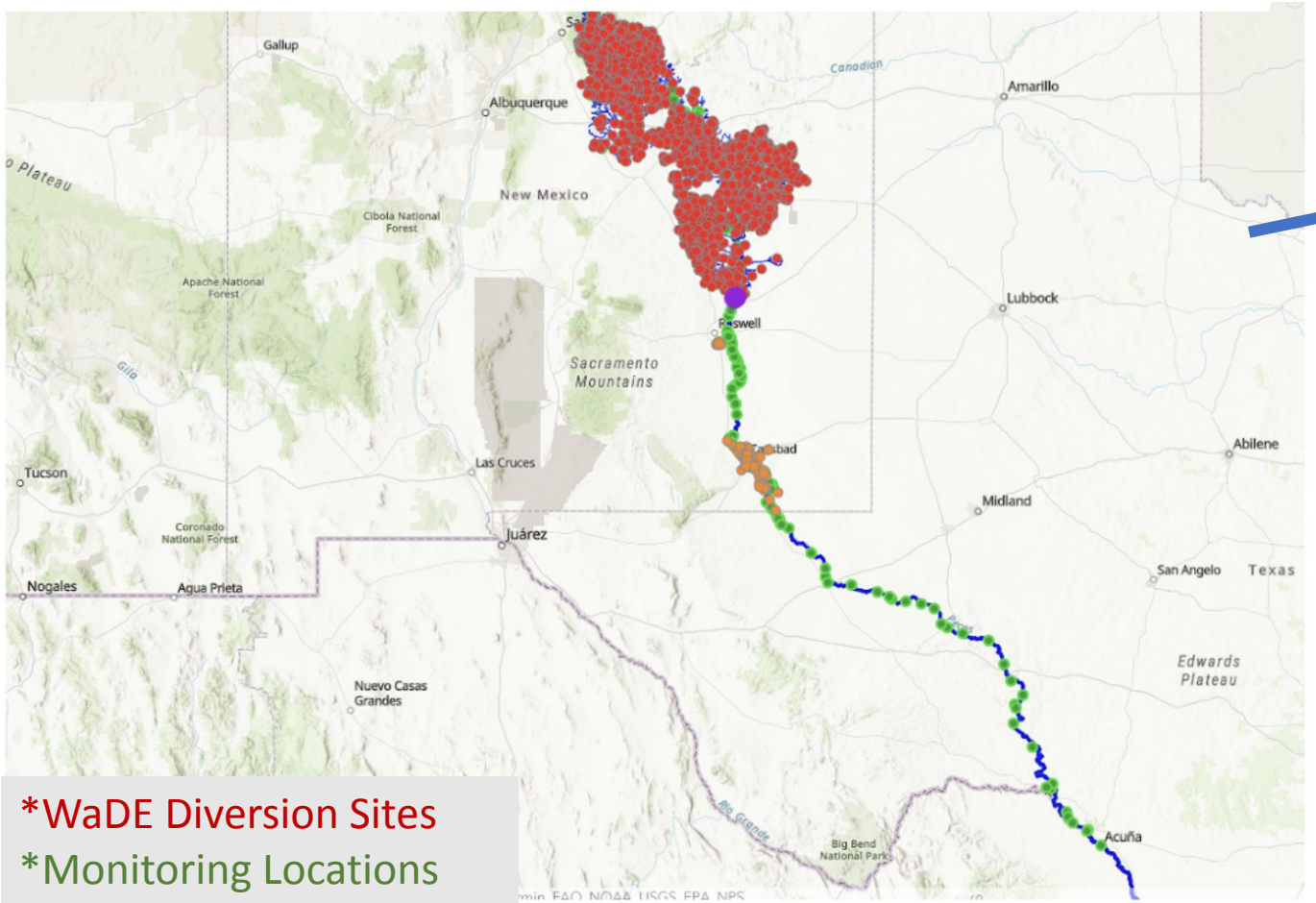
*WaDE Diversion Sites

*Monitoring Locations

Workflow Vision (WaDE Example)

WESTERN STATES WATER COUNCIL

Water diversions time series data



*WaDE Diversion Sites
*Monitoring Locations

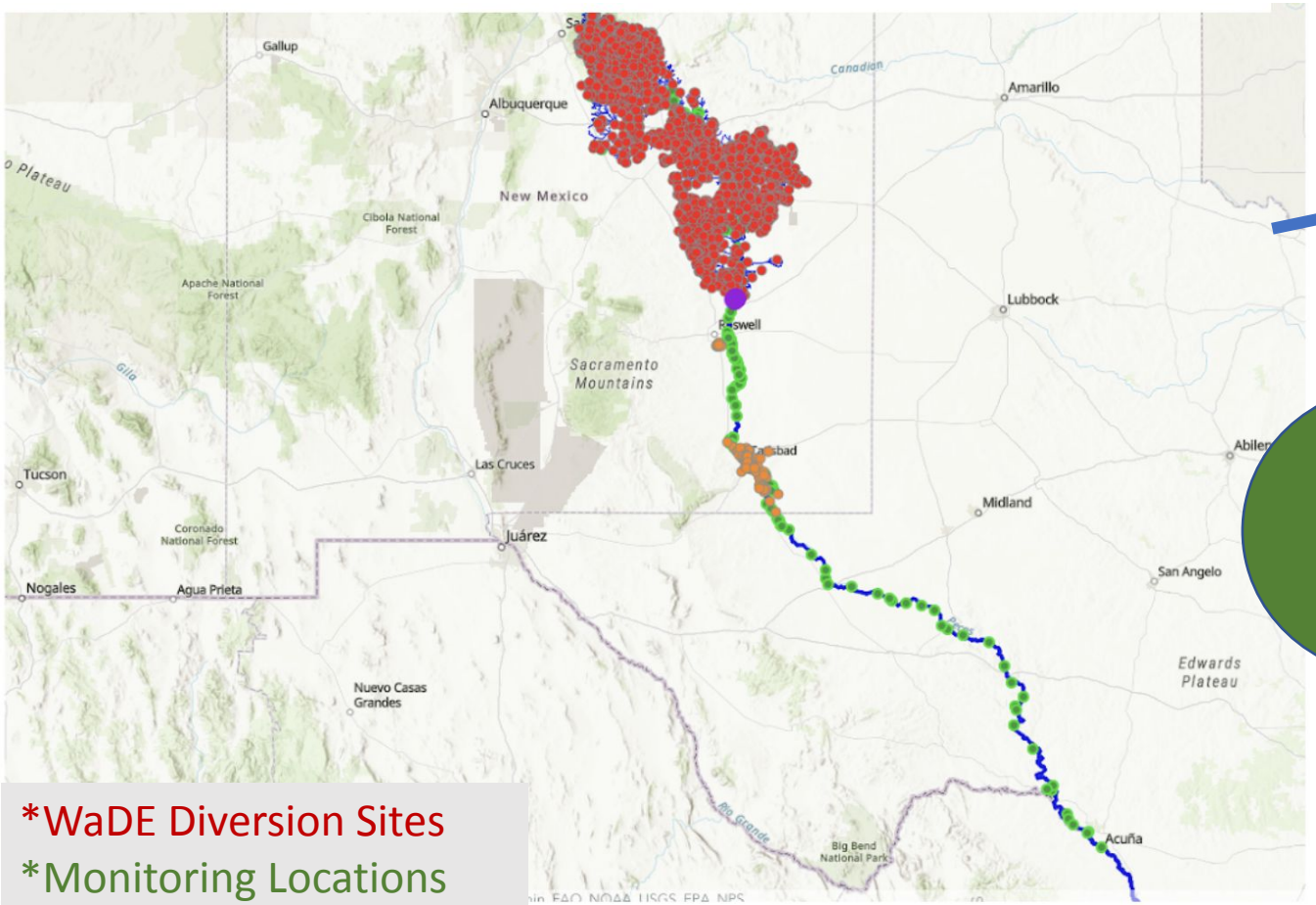
Network Linked Data Index

geoconnex knowledge Graph

Workflow Vision (WaDE Example)

WESTERN STATES WATER COUNCIL

Water diversions time series data



*WaDE Diversion Sites
*Monitoring Locations

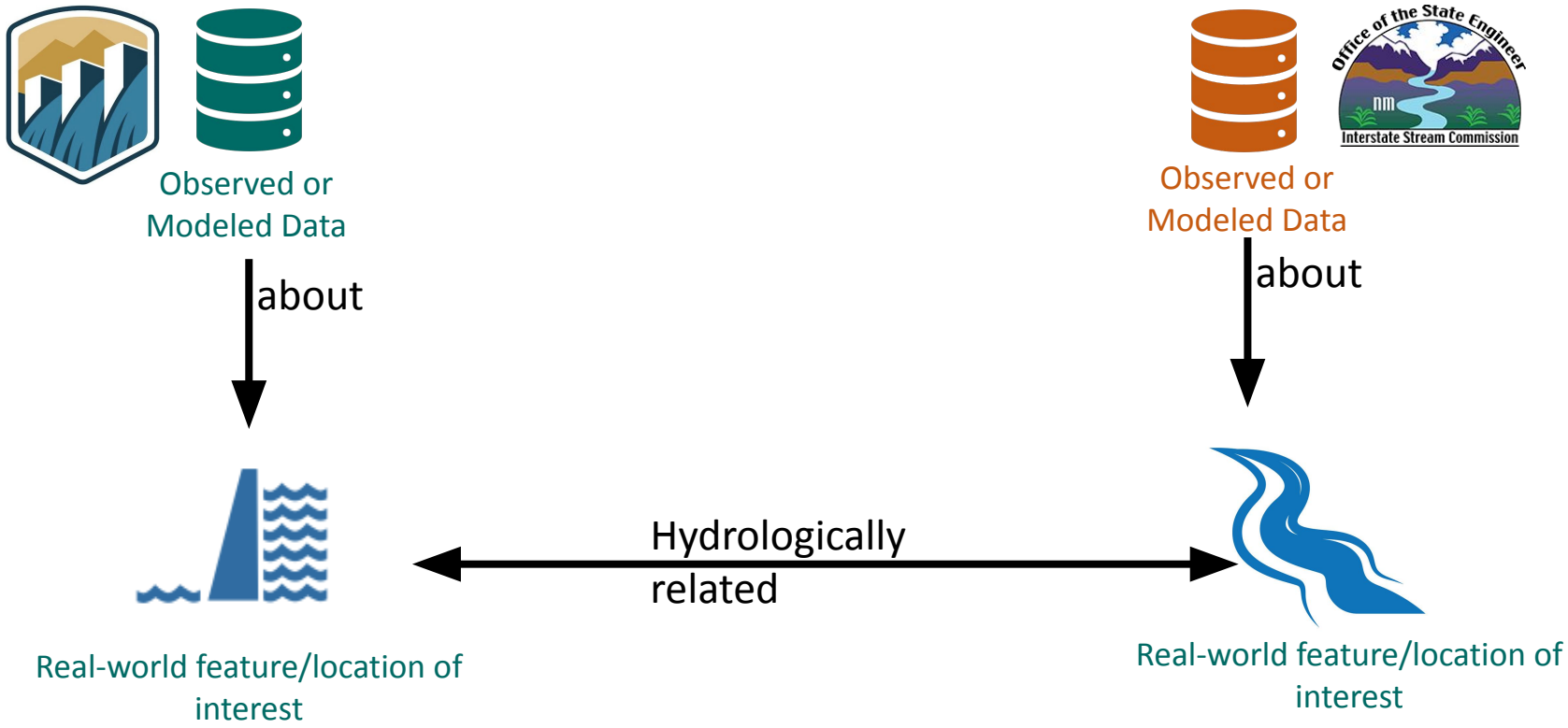
Network Linked Data Index

geoconnex knowledge Graph

USGS data services

NM data services

Geoconnex – enabling conditions for a knowledge graph of water-related data **without** centralizing data governance and storage



Geoconnex – enabling conditions for a knowledge graph of water-related data **without** centralizing data governance and storage

Observed or Modeled Data

about

Real-world feature/location of interest

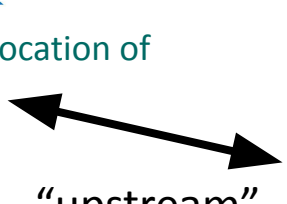
Hydrologically related (eg “upstream”)

Observed or Modeled Data

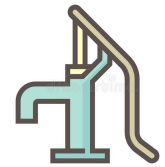
about

Real-world feature/location of interest

“upstream”



Real-world feature/location of interest



Real-world feature/location of interest

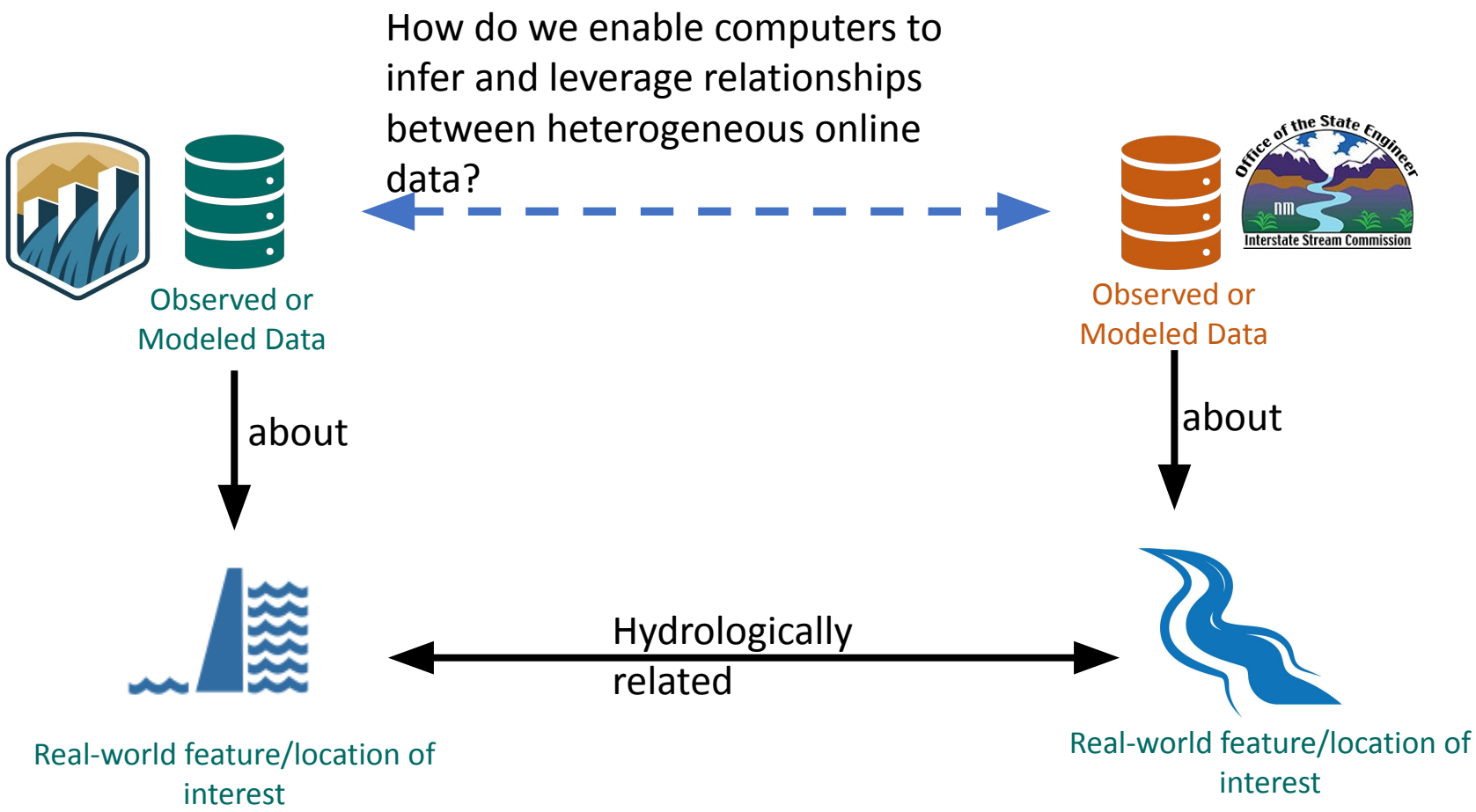
“SW/GW interaction”

Real-world feature/location of interest

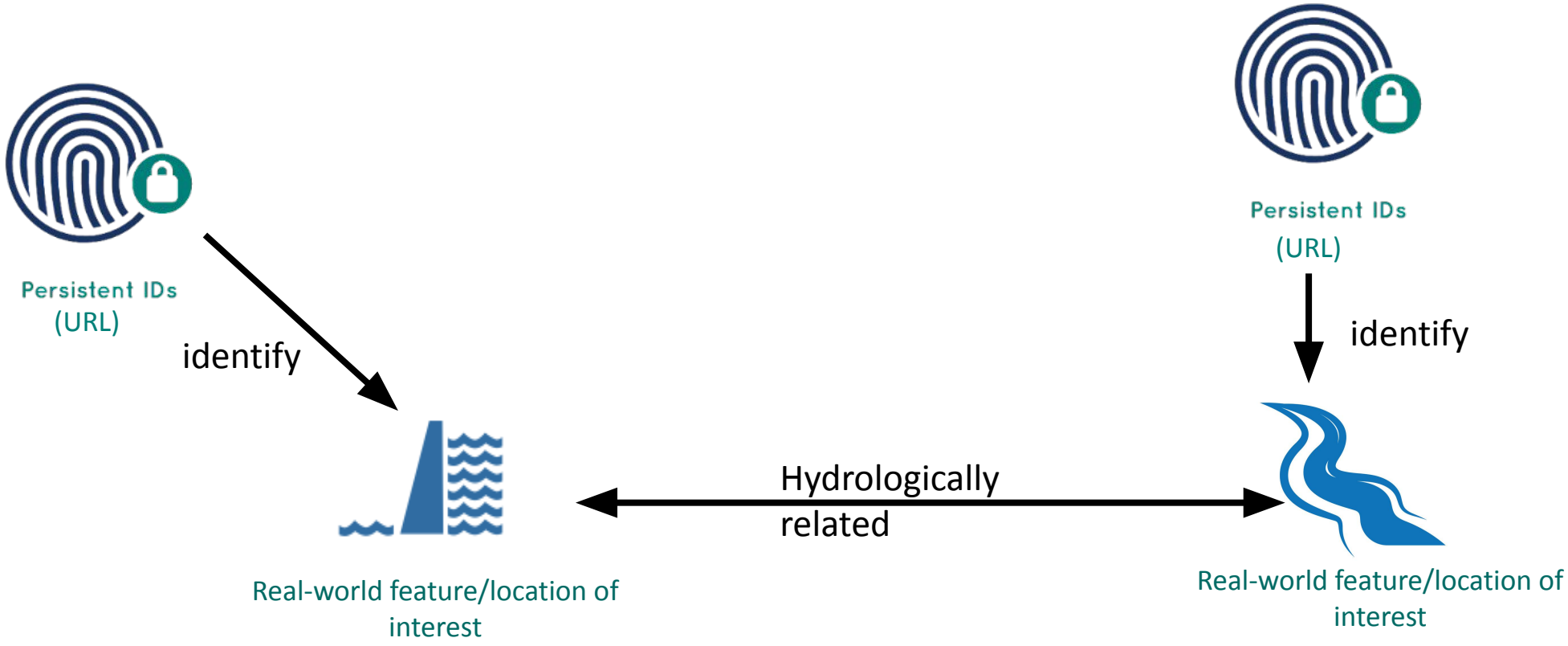
“upstream”

Real-world feature/location of interest

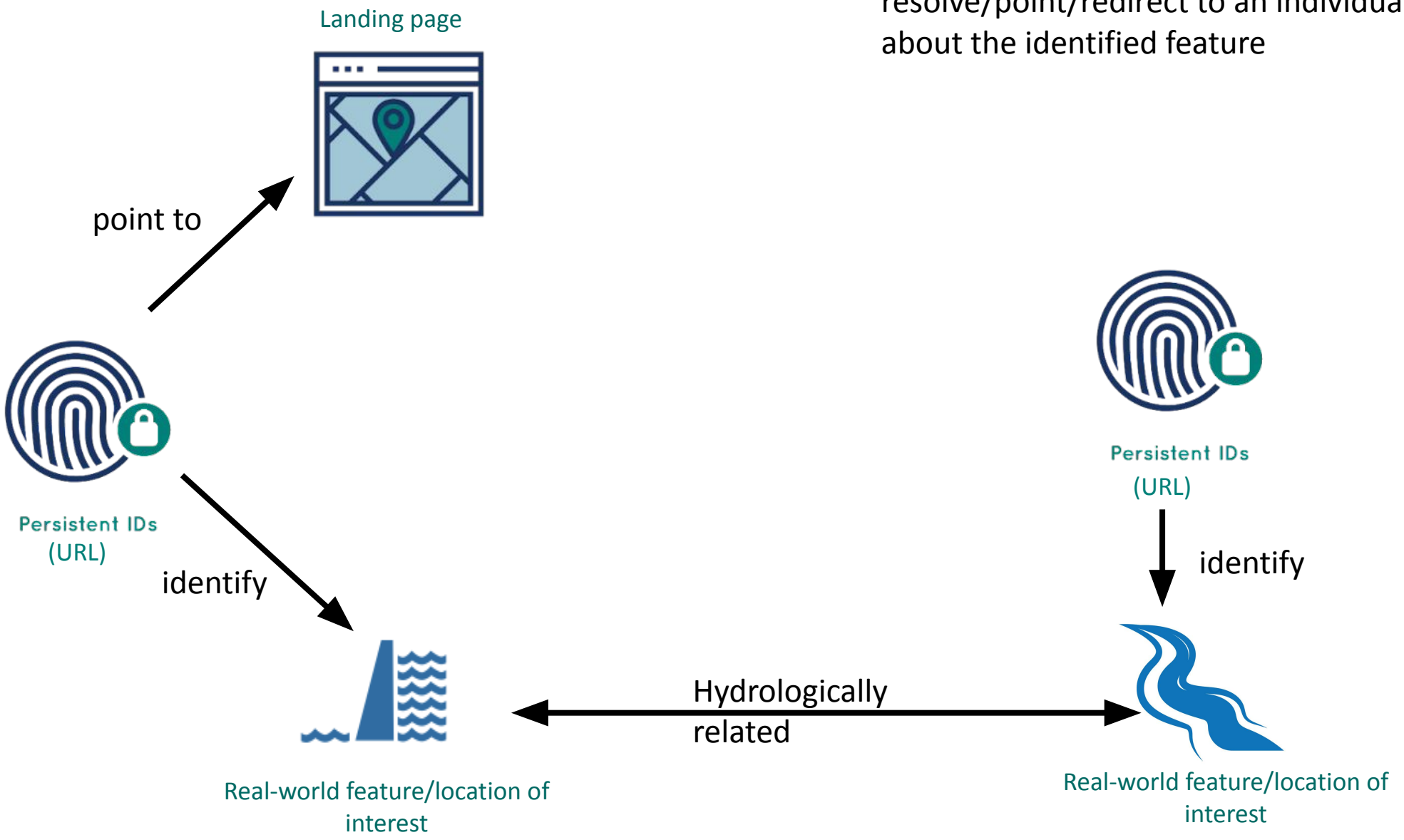
Geoconnex – enabling conditions for a knowledge graph of water-related data **without** centralizing data governance and storage



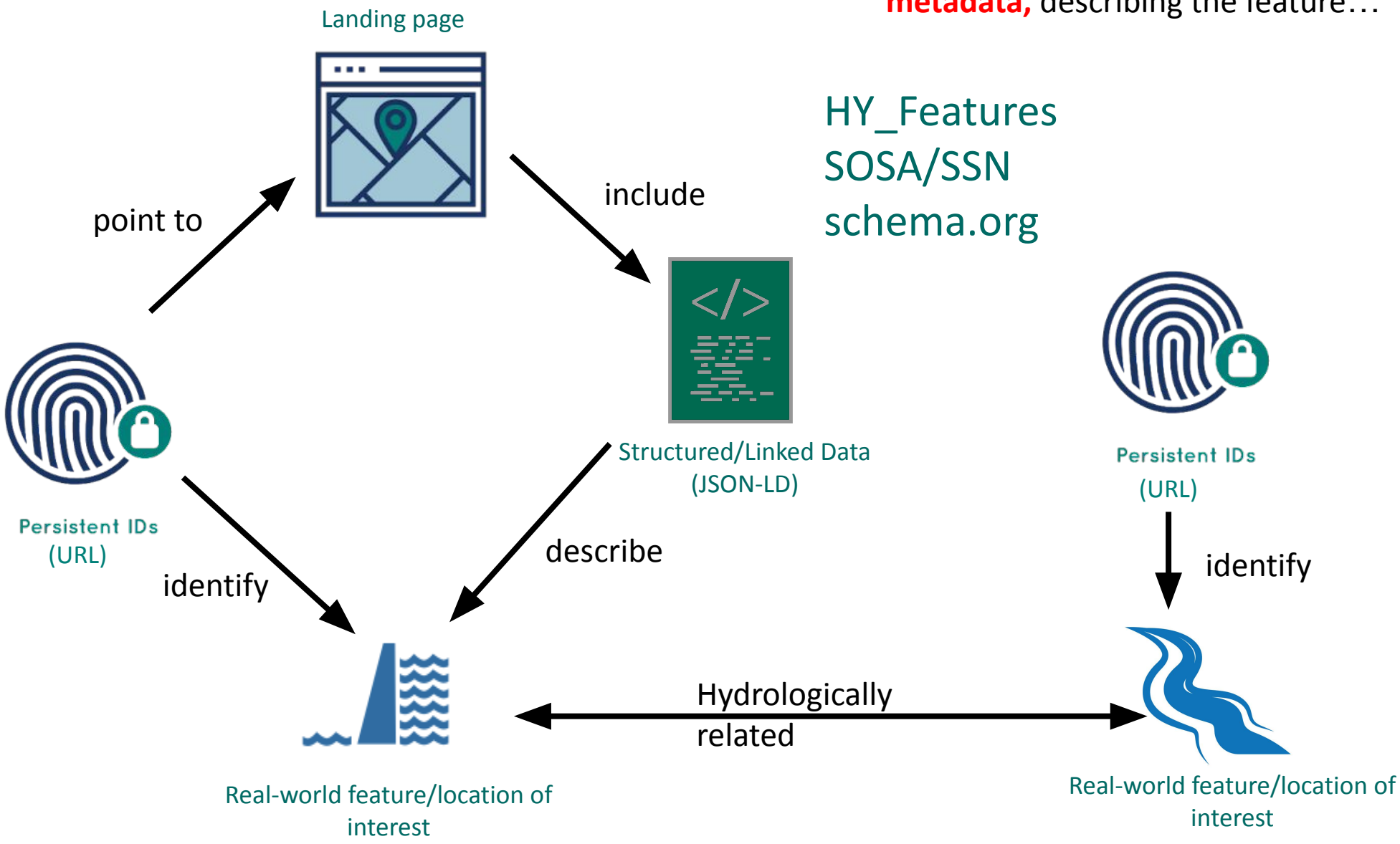
Requirement 1: All sites and environmental features should have universal, **persistent identifiers**



Requirement 2: Each individual persistent identifier should resolve/point/redirect to an individual **landing page** (webpage) about the identified feature

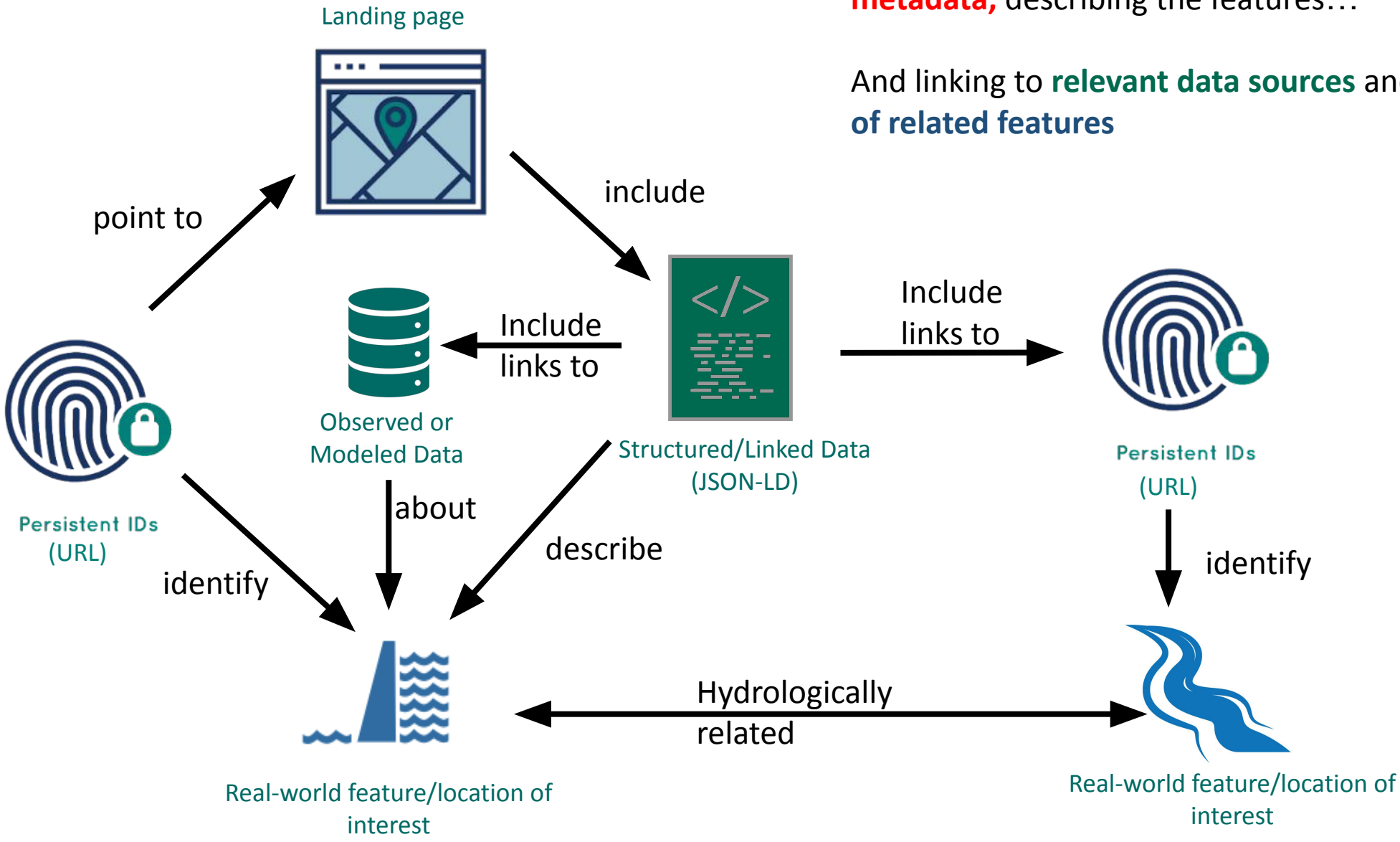


Requirement 3: Landing pages should embed **structured metadata,** describing the feature…



Requirement 3: Landing pages should embed **structured metadata,** describing the features…

And linking to **relevant data sources** and the **persistent identifiers of related features**



https://geoconnex.us
(persistent identifier registry and resolver)

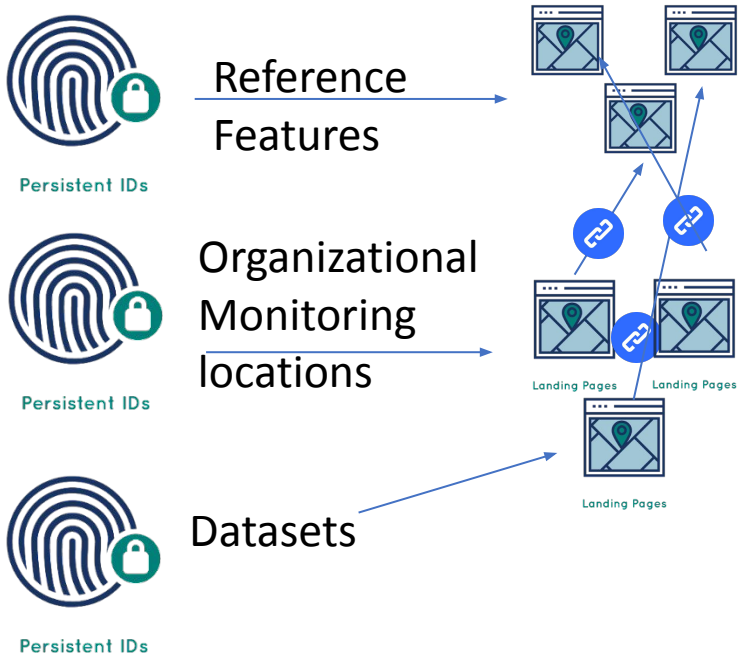
https://geoconnex.us/sitemap.xml

Reference Features

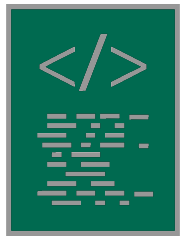
Special features common across organizations (e.g. NHD, mainstem rivers, PLSS, HUCs, census geographies)

https://geoconnex.us
(persistent identifier registry and resolver)

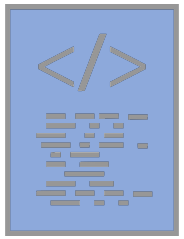
https://geoconnex.us/sitemap.xml



Embedded JSON-LD



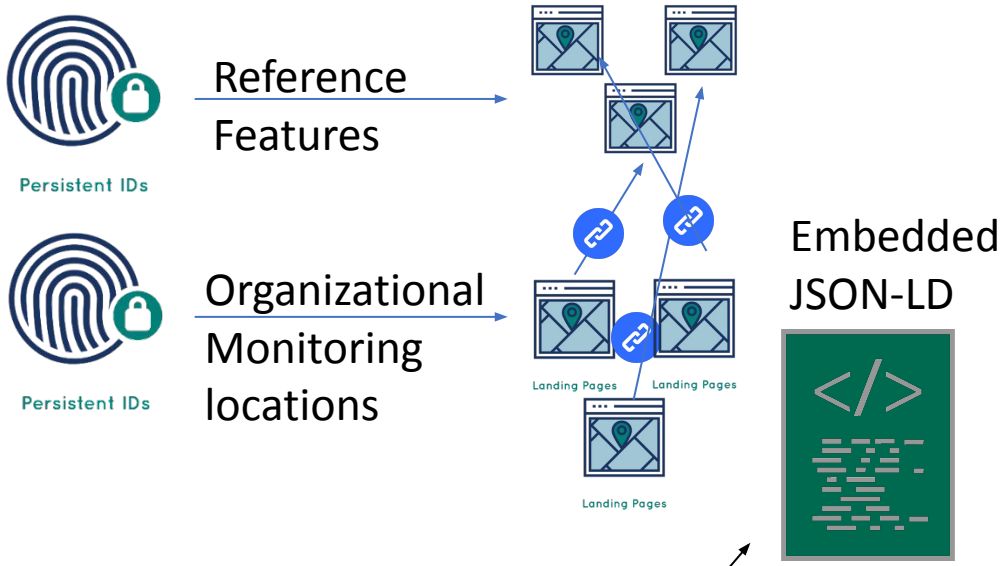
”I am a gage”
“I’m from USGS”
“I am on **this spot** on NHDPlusV2
“USGS has near-real-time data **here** formatted like so



”I am a model point of interest”
“I’m from USBR”
“I am on **this spot** on NHDPlusHR,
“USBR has model data **here** formatted like so

https://geoconnex.us
(persistent identifier registry and resolver)

https://geoconnex.us/sitemap.xml



docs.geoconnex.us
JSON-LD guidance, templates, schemas, vocabularies.
Derived from SELFIE (HY_Features, schema.org, SOSA/SSN)

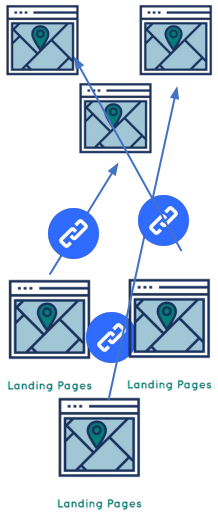
https://geoconnex.us
(persistent identifier registry and resolver)

https://geoconnex.us/sitemap.xml

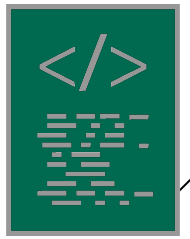
harvest.geoconnex.us

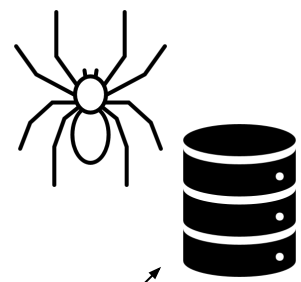
Reference Features

Organizational Monitoring locations



Embedded JSON-LD





Knowledge graph (graph database)

APIs

search.geoconnex.us
graph.geoconnex.us
reference.geoconnex.us

docs.geoconnex.us
JSON-LD guidance, templates, schemas, vocabularies.
Derived from SELFIE (HY_Features, schema.org, SOSA/SSN)

https://geoconnex.us
(persistent identifier registry and resolver)

https://geoconnex.us/sitemap.xml

harvest.geoconnex.us

Knowledge graph

APIs

Persistent IDs

Reference Features

Persistent IDs

Organizational Monitoring locations

Persistent IDs

Datasets

Landing Pages

Landing Pages

Landing Pages

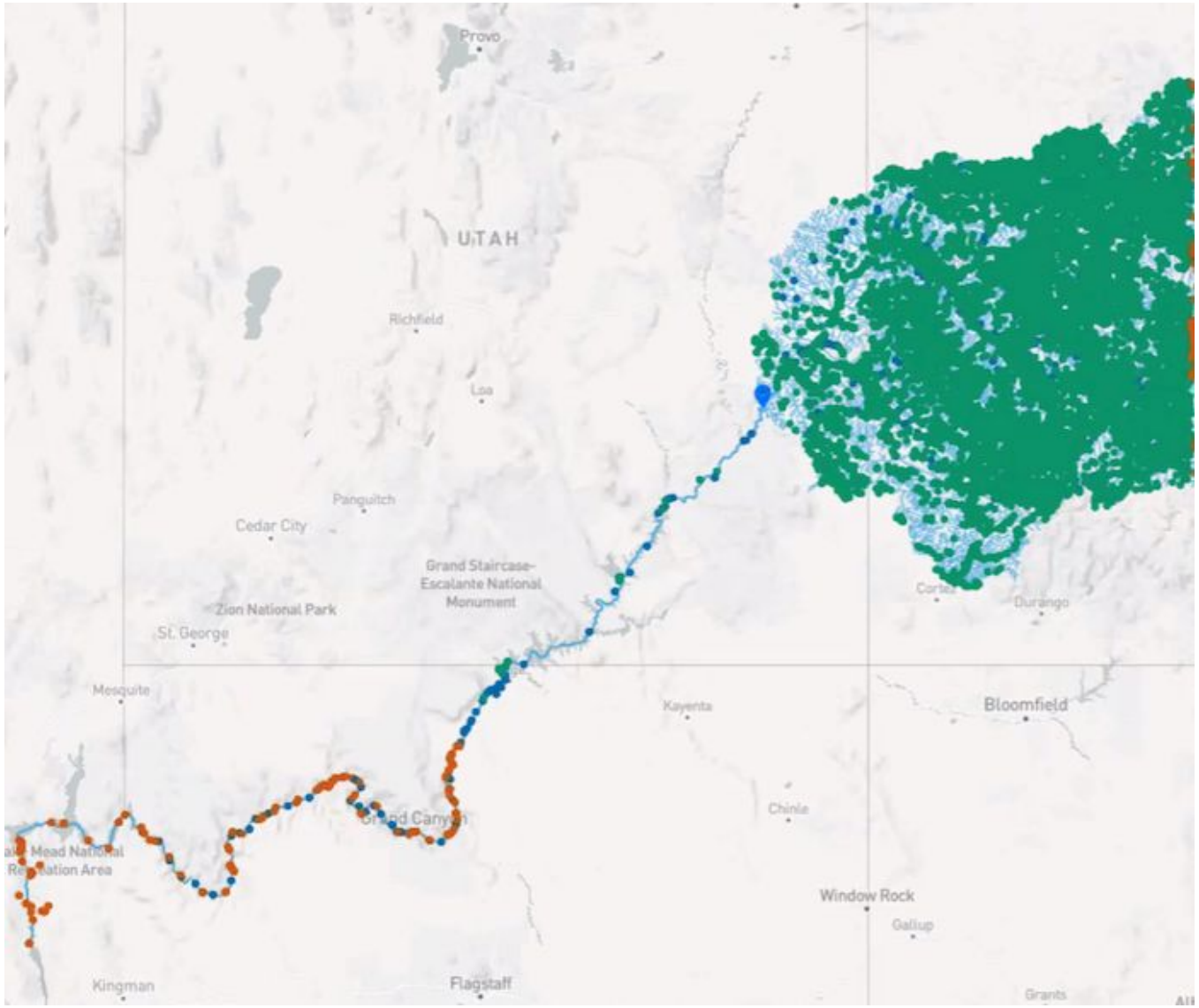
Embedded JSON-LD

”I am a reference location”
“I am on **this spot** on NHDPlusV2, and **this one** on NHDPlusHR”
“USGS has near-real-time data here”
“USBR has model data here”
“**NM OSE** has other data upstream here”

docs.geoconnex.us
JSON-LD guidance, templates, schemas, vocabularies.
Derived from SELFIE (HY_Features, schema.org, SOSA/SSN)

What is the NLDI?

- A RESTful application programming interface (API) in front of the NHD (NHDPlusV2 for now, HR support eventually)
- An open-source project with the codebase available at https://github.com/internetofwater/nldi-services
- Hosted by USGS
- https://labs.waterdata.usgs.gov/about-nldi/index.html
- Anyone can contribute!



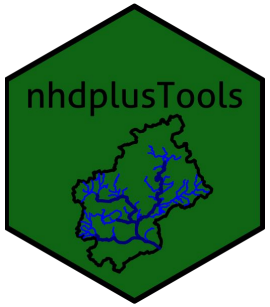
NLDI – How to use

Swagger docs:
https://labs.waterdata.usgs.gov/api/nldi/swagger-ui/index.html

HTTP GET requests ->

Receive GeoJSON ->

Use in analysis, GIS software, custom web applications

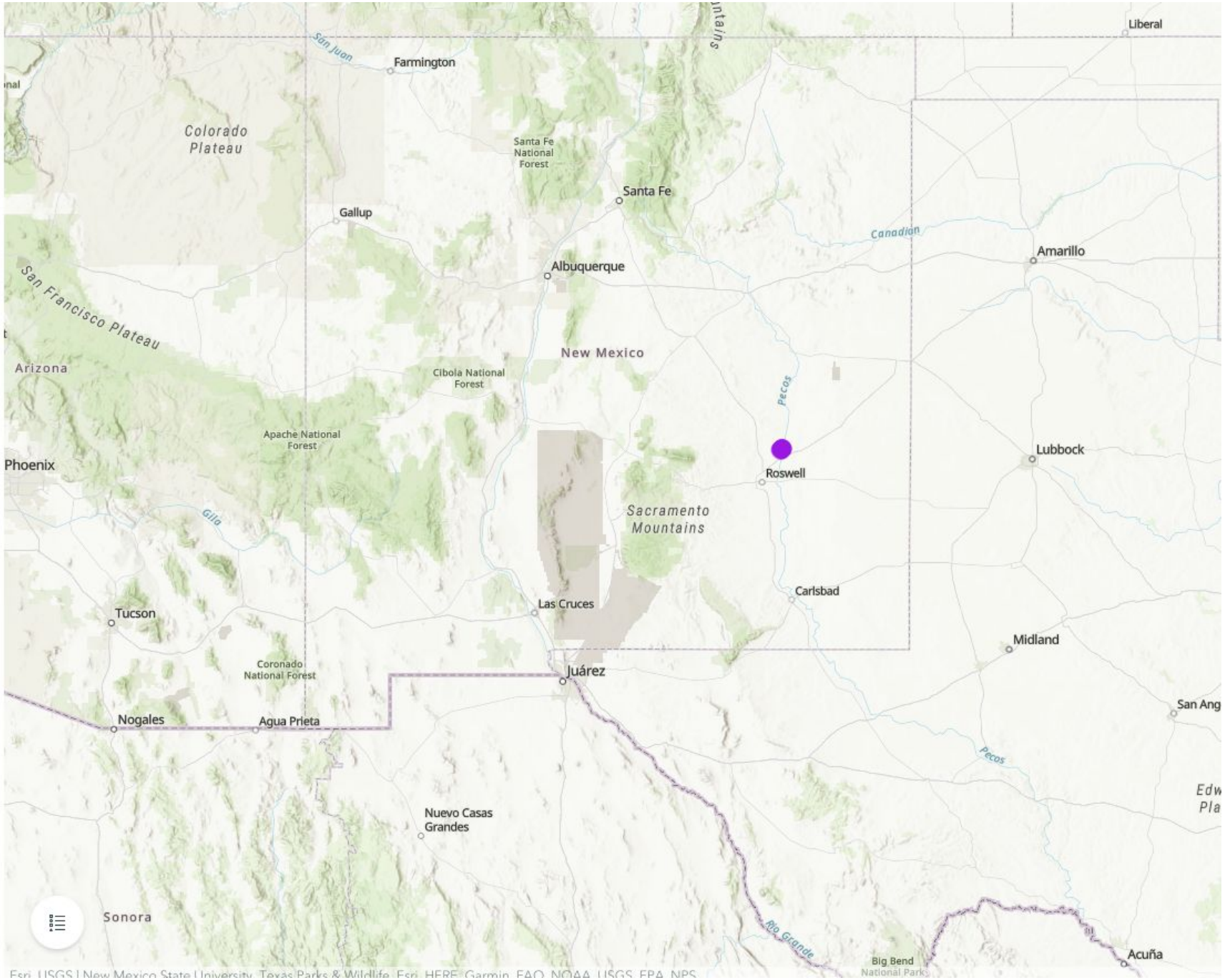


NLDI and Geoconnex – Emerging applications in New Mexico

Begin with a point of interest. For example:

lon: -104.337

lat: 33.675



https://labs.waterdata.usgs.gov/api/nldi/linked-data/comid/postion?coords=POINT(-104.34 33.68)

Use the NLDI COMID endpoint to find the catchment/flowline associated with the point of interest:

https://labs.waterdata.usgs.gov/api/nldi/linked-data/comid/position?coords=POINT(-104.34 33.68)

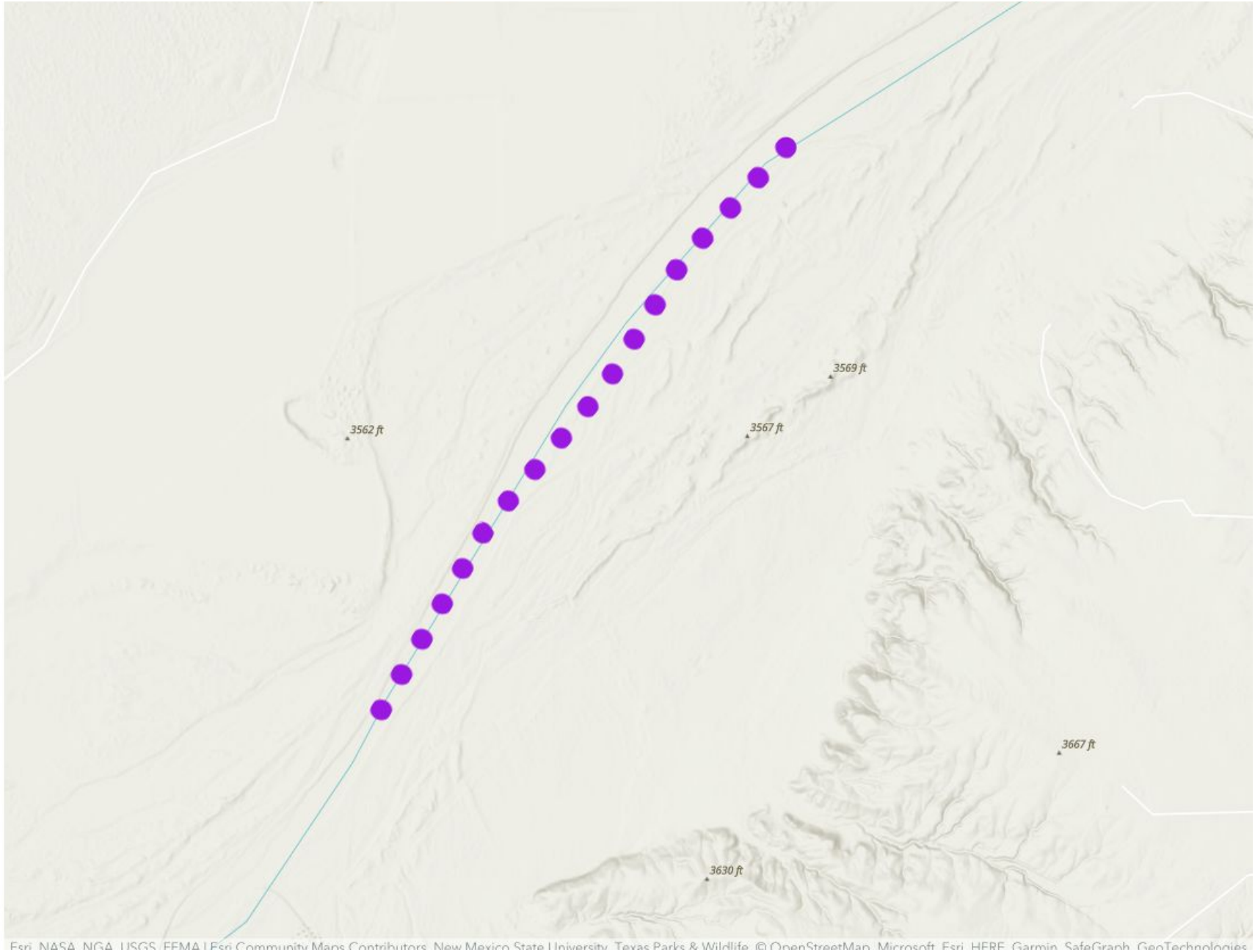
Check "navigation" returned field:

https://labs.waterdata.usgs.gov/api/nldi/linked-data/comid/20805609/navigation

Gives links to "navigate" :

- upstream mainstem river (UM)
- upstream tributaries (UT)
- downstream mainstem (DM)
- downstream diversions (DD)

{"upstreamMain": "https://labs.waterdata.usgs.gov/api/nldi/linked-



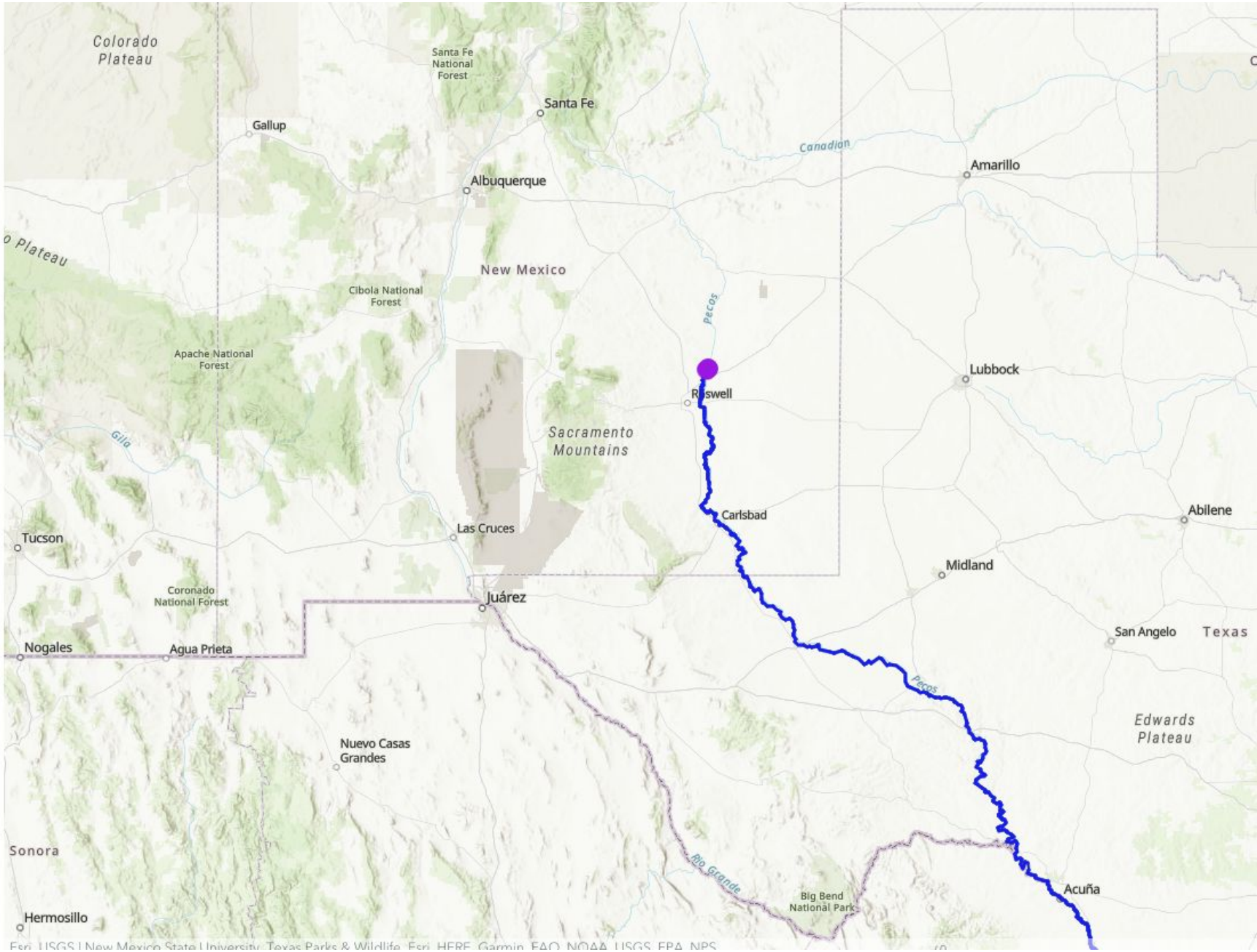
https://labs.waterdata.usgs.gov/api/nldi/linked-data/comid/20805609/navigation/DM/flowlines?distance=3000

From there, can find the features of interest from a start feature (in this case, "comid/")

To find the downstream mainstem flowpath:

https://labs.waterdata.usgs.gov/api/nldi/linked-data/comid/20805609/navigation/DM/flowlines?distance=3000

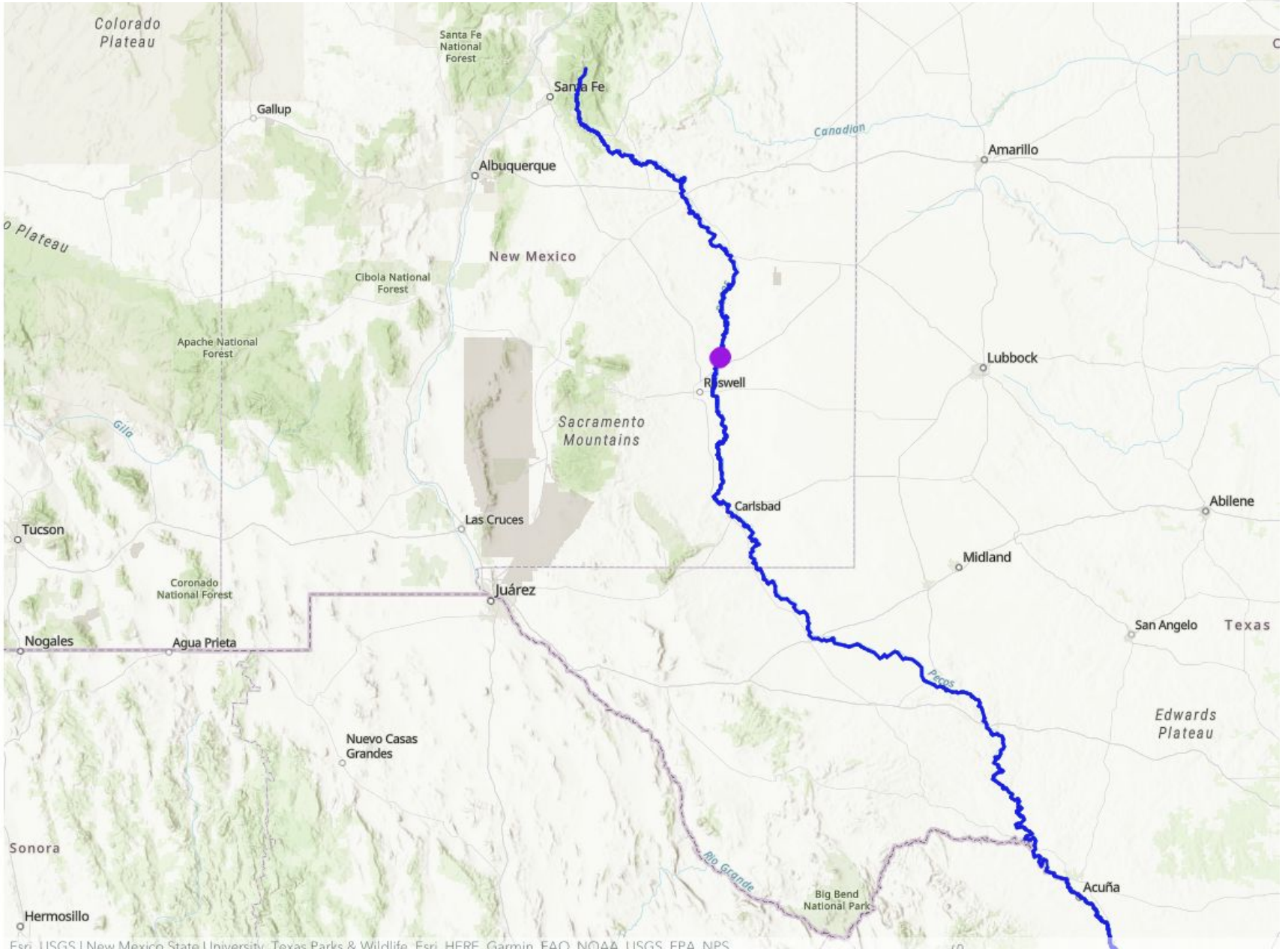
Note the "distance" query parameter, which is distance in kilometers to search.



https://labs.waterdata.usgs.gov/api/nldi/linked-data/comid/20805609/navigation/UM/flowlines?distance=500

We similary find the flowpath for 500km upstream :

https://labs.waterdata.usgs.gov/api/nldi/linked-data/comid/20805609/navigation/UM/flowlines?distance=500



https://labs.waterdata.usgs.gov/api/nldi/linked-data/comid/20805609/navigation/UT/flowlines?distance=500

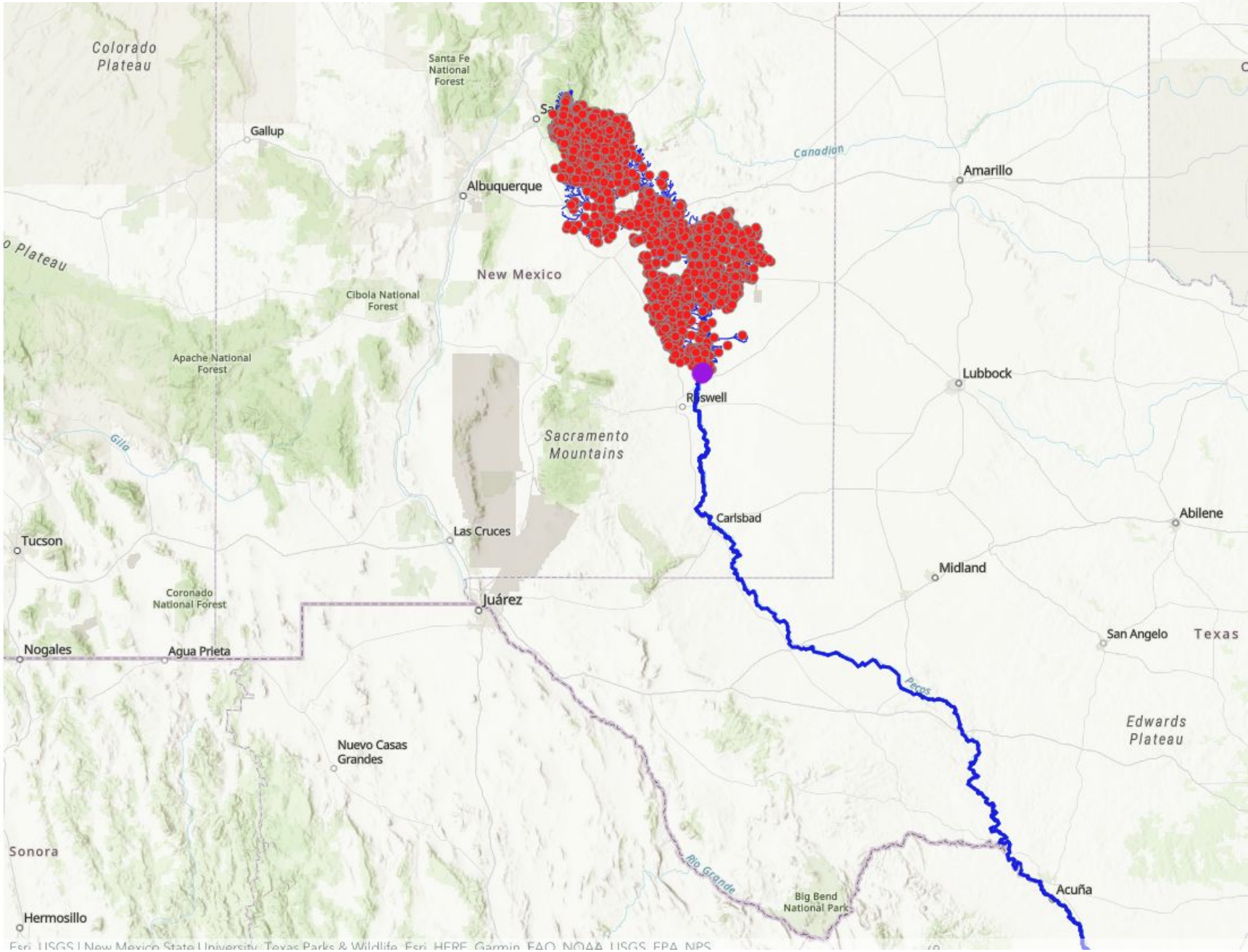
...and the upstream tributaries:

https://labs.waterdata.usgs.gov/api/nldi/linked-data/comid/20805609/navigation/UT/flowlines?distance=500

https://labs.waterdata.usgs.gov/api/nldi/linked-data/comid/20805609/navigation/UT/wade?distance=500

We can also query the NLDI for any location metadata that the community has registered. For example, any points of diversion in WaDE upstream

https://labs.waterdata.usgs.gov/api/nldi/linked-data/comid/20805609/navigation/UT/wade?distance=500



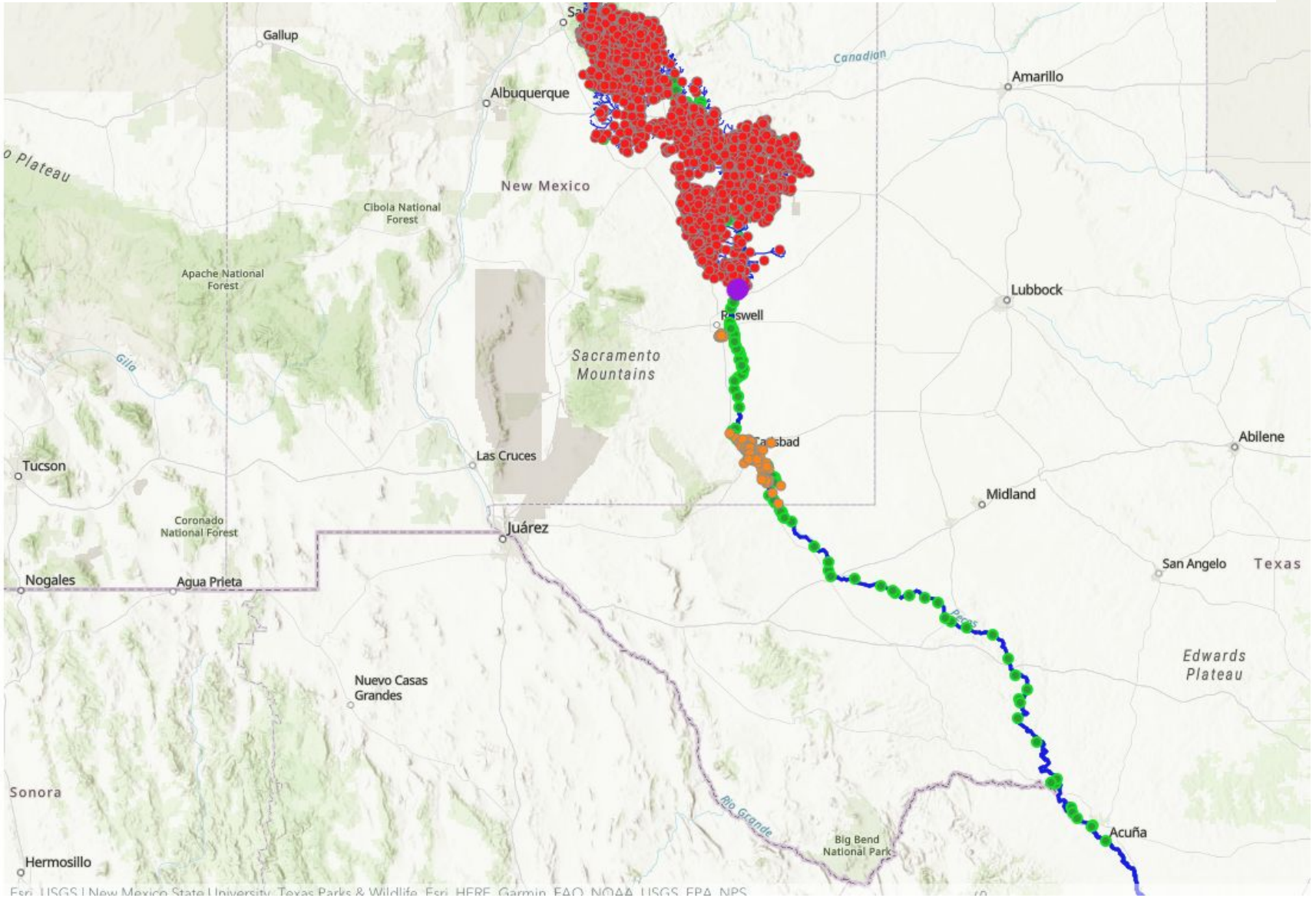
https://labs.waterdata.usgs.gov/api/nldi/linked-data/comid/20805609/navigation/DM/nwissite?distance=3000

https://labs.waterdata.usgs.gov/api/nldi/linked-data/comid/20805609/navigation/DM/nmwdi-st?distance=3000

...as well as sites from any other contributing organization

(USGS)/navigation/DM/nwissite?distance=3000

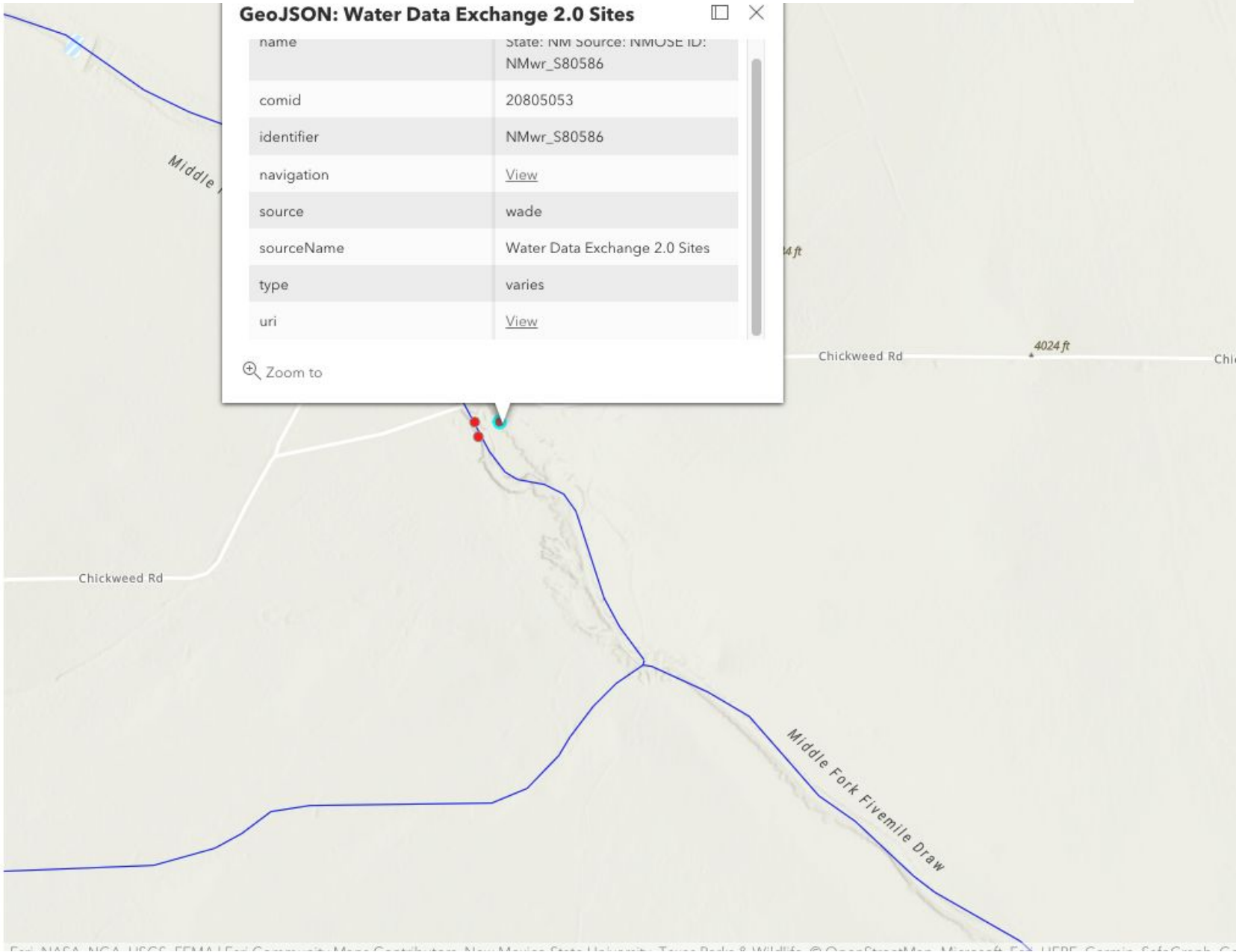
(New Mexico Bureau of Geology)
/navigation/DM/nmwdi-st?distance=3000)



Each point in the NLDI has a URI which should point to a page where source information is available
Example: https://geoconnex.us/wade/sites/NMwr_S80586

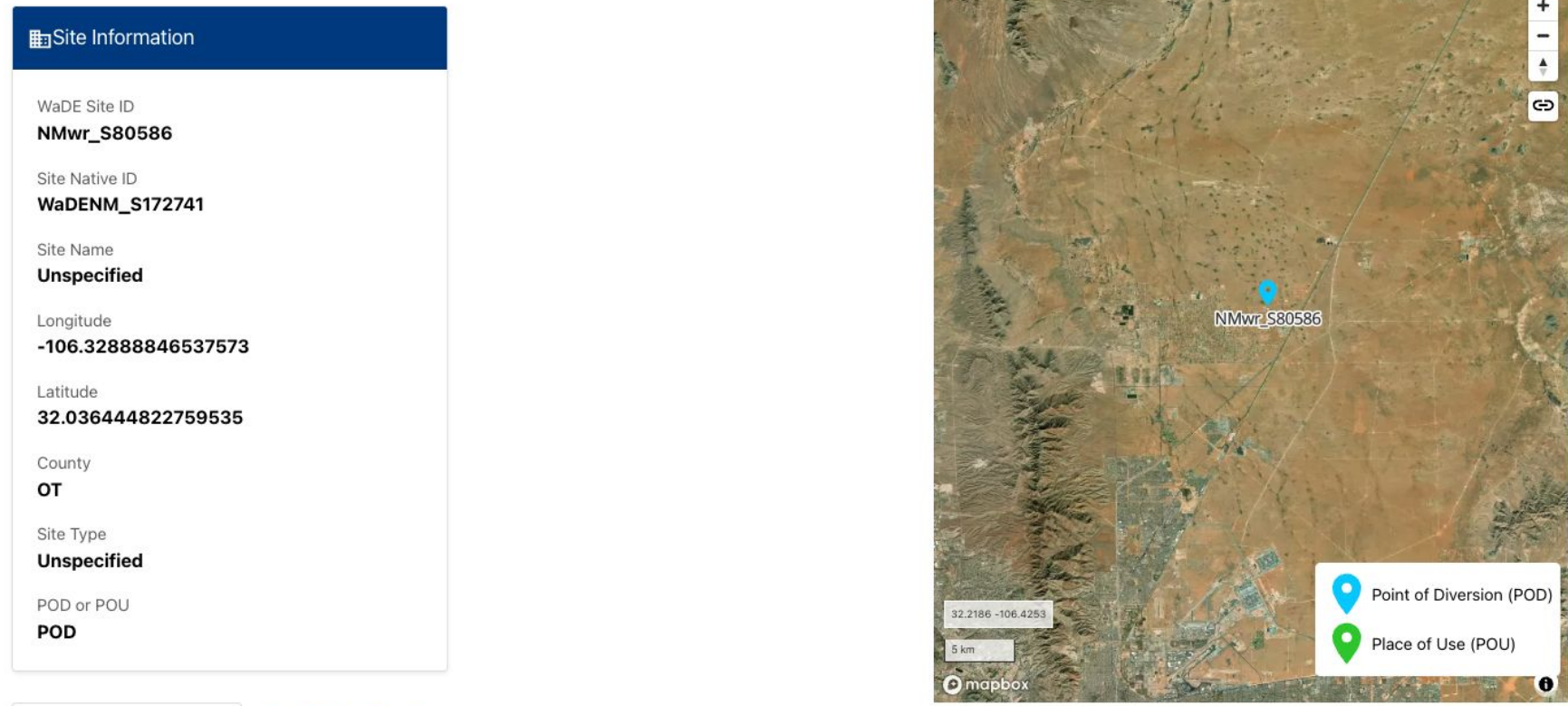
If we inspect our sites, we see the "uri" field, which is a persistent identifier registered at geoconnex.us by the contributing organization.

https://geoconnex.us/wade/sites/NMwr_S80586



Which redirects to

https://westdaatqa.westernstateswater.org/details/site/NMwr_S80586



WaDE Water Source ID	Water Source Native ID	Water Source Name	Water Source Type
NMwr_WS1	WaDENM_WS1	Unspecified	Groundwater

Current work w/ NMWDI

USGS uri

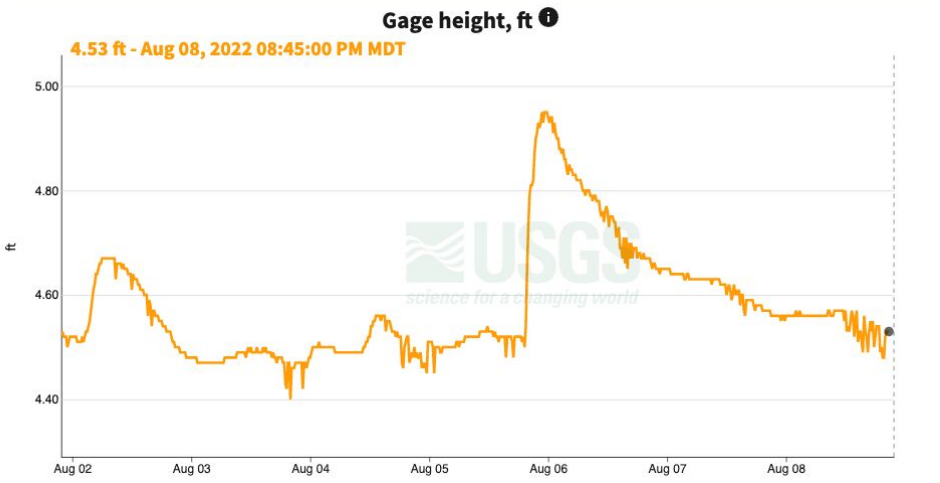
PECOS RIVER NEAR ACME, NM

IMPORTANT Legacy real-time page

Monitoring location 08386000 is associated with a STREAM in CHAVES COUNTY, NEW MEXICO. Current conditions of DISCHARGE and GAGE HEIGHT are available. Water data back to 1900 are available online.

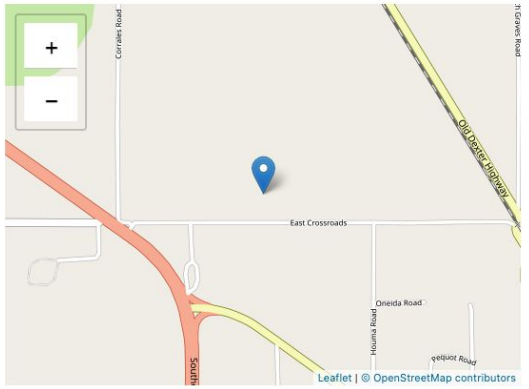
7 days 30 days 1 year

Change time span | Retrieve data



NMWDI/OSE uri

Item 2950



Property	Value
geoconnex	https://geoconnex.us/nmwdi/s...
id	2950
description	Well drilled or set into subsurface for the purposes of pumping water or monitoring groundwater
name	Water Well
@iot.selfLink	https://st2.newmexicowaterda... Server/v1.1/Things(2950)
Locations	*description:* Location of well where measurements are made *encodingType:* application/vnd.geo+json *@iot.id:* 2950 *location: type:* Point *coordinates:* -104.4631611130099 33.307257982592944 *name:* NM-26846

Current work w/ NMWDI

USGS uri (JSON-LD)

```
<script type="application/ld+json">
{
  "@context": [
    "https://opengeospatial.github.io/ELFIE/json-ld/elf-index.jsonld",
    "https://opengeospatial.github.io/ELFIE/json-ld/hyf.jsonld"
  ],
  "@id": "https://waterdata.usgs.gov/monitoring-location/08385503",
  "@type": "http://www.opengeospatial.org/standards/waterml2/hy_features/HY_HydroLocation",
  "name": "SAND GATE DIV FROM FT SUMNER CANAL AT FT SUMNER,NM",
  "sameAs": "https://waterdata.usgs.gov/nwis/inventory/?site_no=08385503",
  "HY_HydroLocationType": "hydrometricStation",
  "geo": {
    "@type": "schema:GeoCoordinates",
    "latitude": "34.4758333",
    "longitude": "-104.2583333"
  },
  "image": "https://waterdata.usgs.gov/nwisweb/graph?agency_cd=USGS&site_no=08385503&parm_cd=00060&period=100"
}
</script>
```

NMWDI uri (JSON-LD)

```
{
  @context: [
    {
      schema: "https://schema.org/",
      geoconnex: "@id",
      type: "@type",
      geosparql: "http://www.opengis.net/ont/geosparql#"
    },
    {
      sosa: "http://www.w3.org/ns/sosa/",
      ssn: "http://www.w3.org/ns/ssn/",
      Datastreams: "sosa:ObservationCollection",
      name: "schema:name",
      Locations: "schema:location",
      description: "schema:description"
    }
  ],
  type: "schema:Place",
  id: "6572",
  description: "Well drilled or set into subsurface for the purposes of pumping water or monitoring groundwater",
  name: "Water Well",
  @iot.selfLink: "https://st2.newmexicowaterdata.org/FROST-Server/v1.1/Things(6572)",
  Locations: [
    {
```

Current work w/ NMWDI

USGS uri (JSON-LD)


```
<script type="application/ld+json">
{
"@context": [
"https://opengeospatial.github.io/ELFIE/json-ld/elf-index.jsonld",
"https://opengeospatial.github.io/ELFIE/json-ld/hyf.jsonld"
],
"@id": "https://waterdata.usgs.gov/monitoring-location/08385503",
"@type": "http://www.opengeospatial.org/standards/waterml2/hy_features/HY_HydroLocation",
"name": "SAND GATE DIV FROM FT SUMNER CANAL AT FT SUMNER,NM",
"sameAs": "https://waterdata.usgs.gov/nwis/inventory/?site_no=08385503",
"HY_HydroLocationType": "hydrometricStation",
"geo": {
"@type": "schema:GeoCoordinates",
"latitude": "34.4758333",
"longitude": "-104.2583333"
},
"image": "https://waterdata.usgs.gov/nwisweb/graph?agency_cd=USGS&site_no=08385503&parm_cd=00060&period=100"
}
</script>
```


NMWDI uri (JSON-LD)


```
{
@context: [
{
schema: "https://schema.org/",
geoconnex: "@id",
type: "@type",
geosparql: "http://www.opengis.net/ont/geosparql#"
},
{
sosa: "http://www.w3.org/ns/sosa/",
ssn: "http://www.w3.org/ns/ssn/",
Datastreams: "sosa:ObservationCollection",
name: "schema:name",
Locations: "schema:location",
description: "schema:description"
}
],
type: "schema:Place",
id: "6572",
description: "Well drilled or set into subsurface for the purposes of pumping water or monitoring groundwater",
name: "Water Well",
@iot.selfLink: "https://st2.newmexicowaterdata.org/FROST-Server/v1.1/Things(6572)",
Locations: [
{
```


Link to SensorThings API endpoint for measured streamflow

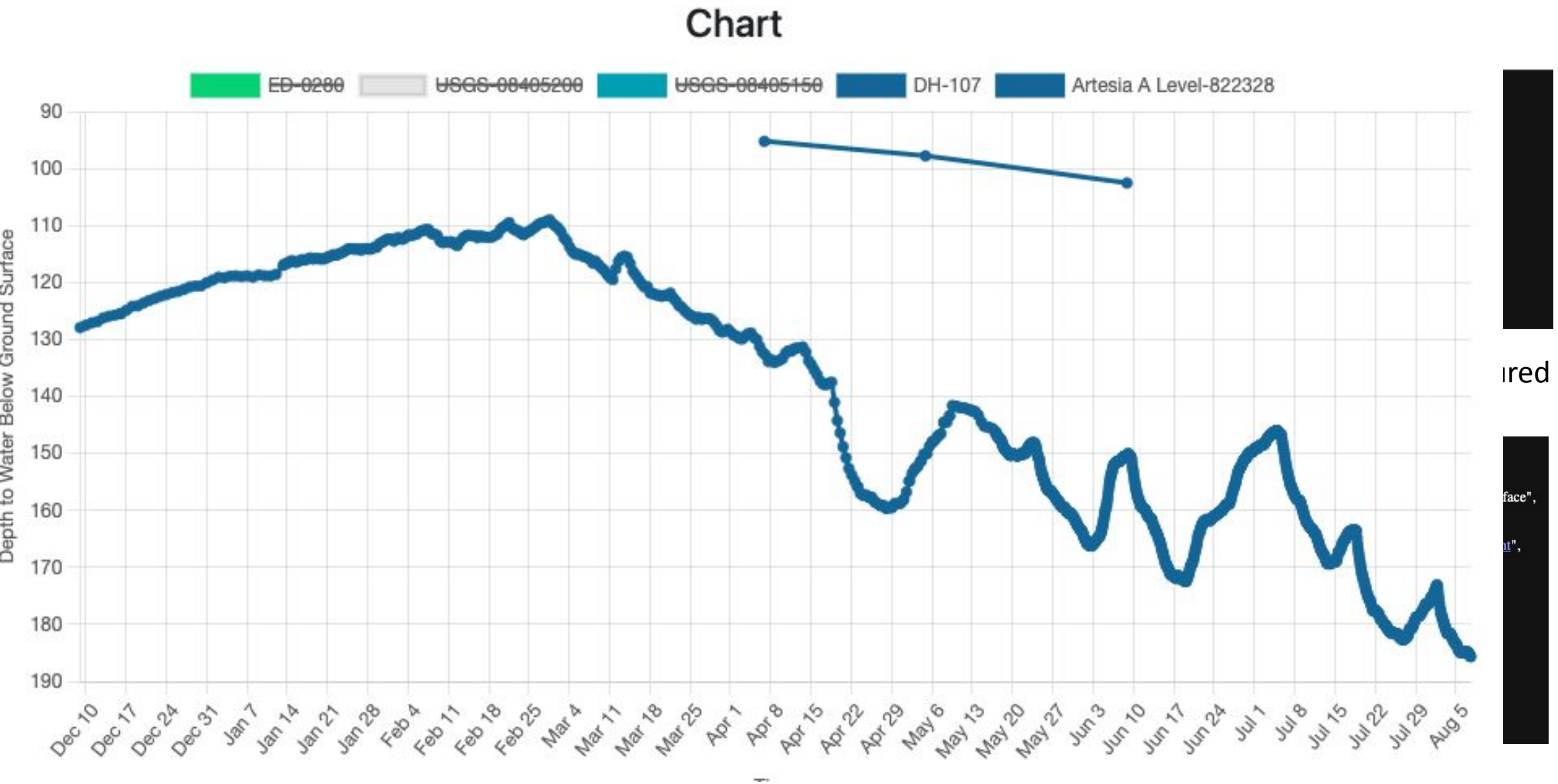

```
value: [
{
description: "Gage height / USGS-08385503-edd58eee130946949ed7d12e7bf01a96",
@iot.id: "edd58eee130946949ed7d12e7bf01a96",
name: "edd58eee130946949ed7d12e7bf01a96",
observationType: "Instantaneous",
observedArea: {
type: "Point",
coordinates: [
-104.2583333,
34.4758333
]
},
phenomenonTime: "2021-08-31T06:00:00.000Z/2022-08-09T03:30:00.000Z",
properties: {
Thresholds: [
{
Name: "Operational limit (minimum) 06/16 levels",
Type: "ThresholdBelow",
Periods: [
{
EndTime: "9999-12-31T23:59:59.9999999+00:00",
StartTime: "2017-03-10T00:00:00.0000000-07:00",
SuppressData: true,
ReferenceValue: 0.73,
ReferenceValueToTriggerDisplay: 0
}
],
ReferenceCode: "Operational limit - low-Public"
},
```


Link to SensorThings API endpoint for measured withdrawals/pumping/groundwater levels


```
{
value: [
{
description: "Measurement of groundwater depth in a water well, as measured below ground surface",
@iot.id: 23165,
name: "Groundwater Levels",
observationType: "http://www.opengis.net/def/observationType/OGC-OM/2.0/OM_Measurement",
observedArea: {
type: "Point",
coordinates: [
-104.302383508784,
32.4837310997202
]
},
phenomenonTime: "1948-09-07T00:00:00.000Z/1948-09-07T00:00:00.000Z",
properties: {
topic: "Water Quantity"
},
resultTime: "1948-09-07T00:00:00.000Z/1948-09-07T00:00:00.000Z",
```

Current work w/ NMWDI

GOAL: Single piece of software can read/chart/download observation data from any compliant provider without knowing anything about them ahead of time



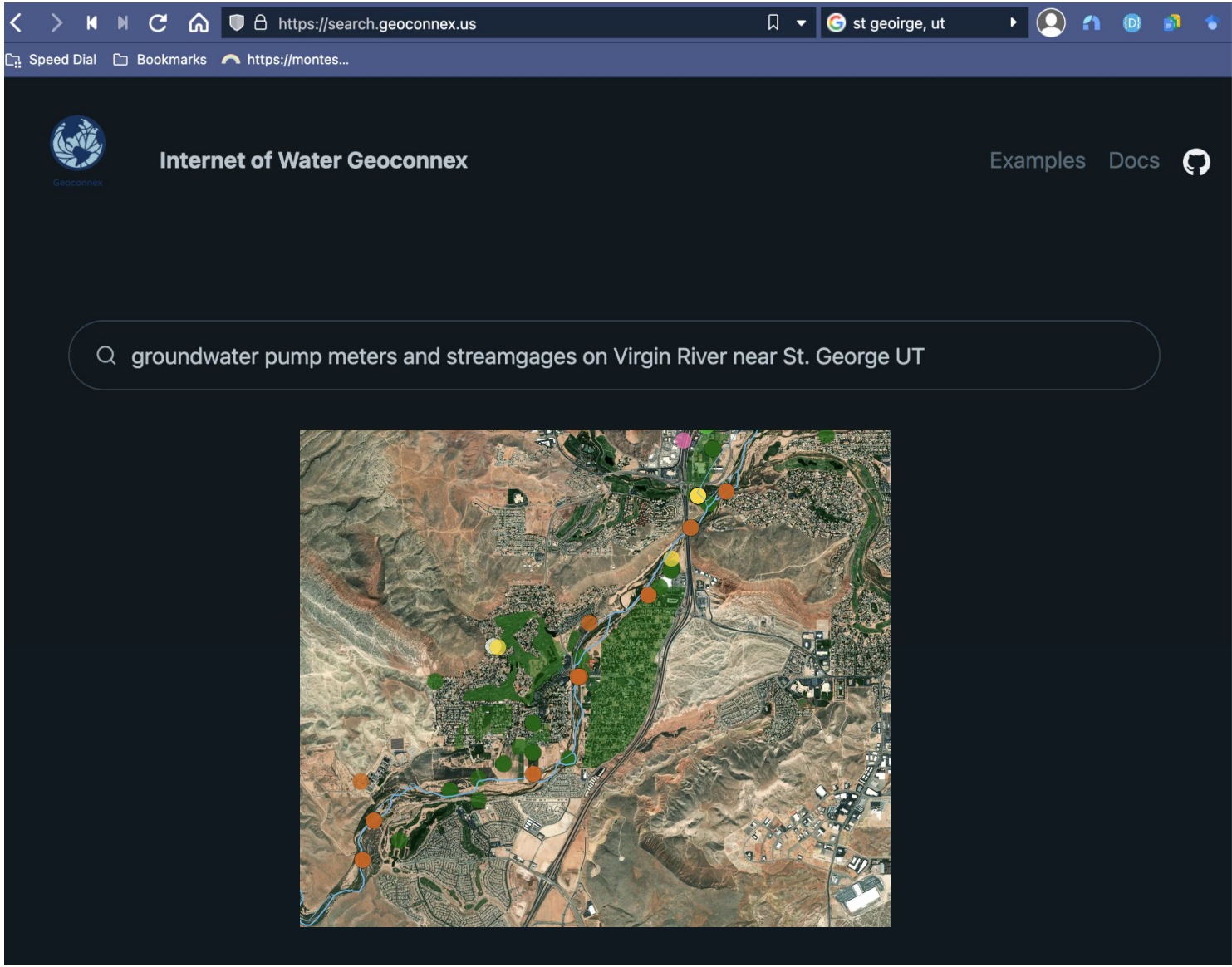
Future work

OGC/WMO Water Quality Interoperability Experiment

- Standardize water quality data exchange formats
- Pilot use of SensorThings API for Water Quality sensors (time series) + samples

Future work

Semantic search on top of NLDI-based search



Future work

More participation in the system

- USBR RISE
- Oak Ridge National Lab + National Hydropower Association (hydropower data)
- Texas Water Development Board
- Others??

Thank you

- Geoconnex Documentation at https://docs.geoconnex.us

- Reach out about Geoconnex at https://github.com/internetofwater/geoconnex.us

- NLDI Documentation at https://labs.waterdata.usgs.gov/about-nldi/index.html

- Reach out about NLDI at https://github.com/internetofwater/nldi-services

Kyle Onda (Lincoln Institute): konda@lincolninst.edu
David Blodgett (USGS): dblodgett@usgs.gov

RESERVE TUTORIAL SLIDES

How to contribute to geoconnex.us and the NLDI

1. Hydro-address your location data (see Mike Tinker's presentation)

   geoconnex steps

2. Publish feature-level landing content with embedded JSON-LD and persistent identifiers
3. Mint persistent identifiers with https://geoconnex.us

   NLDI Steps

4. Publish a geojson file with your hydro-addressed location data (can be same as step 2)
5. Register your geojson file with the NLDI repository

1. Hydro Address your data

1. Use HydroAdd to add NHD Reachcodes and Measures to your locations

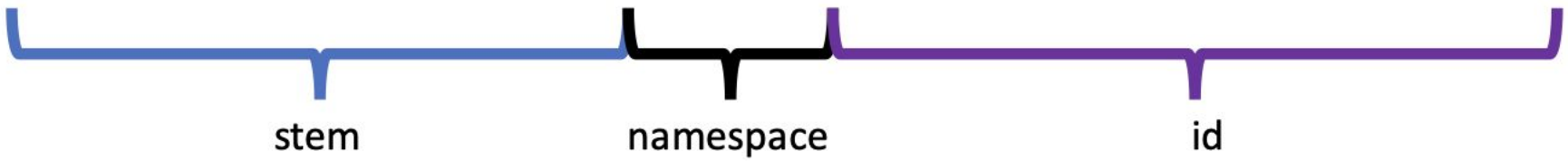
Example: https://github.com/internetofwater/gwtc2022-workshop/blob/main/landing_pages/data/data.csv

	A	F	G	H	I	J	
1	SourceID	ReachCode	Measure	ReachSMDat	AddressDate	Catchment	H
2	TX05845	11120104003353	11.83387	40906	44621.0632	0	
3	TX04180	11120104001618	51.40588	40906	44621.0632	0	
4	TX03713	11120104001376	23.39122	40906	44621.0632	0	
5	TX03714	11120104001376	68.86861	40906	44621.0632	0	
6	TX06624	11120105000037	30.98668	42797.7118	44621.0632	0	

2. Publish feature-level landing content with embedded JSON-LD and persistent identifiers

1. Create a persistent identification scheme:

https://geoconnex.us/my-org/topic/.../hierarchy/12345



Examples:

https://geoconnex.us/usgs/monitoring-location/08332622

https://geoconnex.us/epa/hmw/030300020607

2. Publish feature-level landing content with embedded JSON-LD and persistent identifiers

2. Add the persistent identifiers to your data

Example: https://github.com/internetofwater/gwtc2022-workshop/blob/main/landing_pages/data/data.csv

A	B	G	H	I	J
SourceID	uri	Latitude	Longitude	ReachCode	Measure
TX05845	https://geoconnex.us/iow/demo/TX05845	34.64833	-101.8567	11120104003353	11.83387
TX04180	https://geoconnex.us/iow/demo/TX04180	34.565	-101.7283	11120104001618	51.40588
TX03713	https://geoconnex.us/iow/demo/TX03713	34.68	-101.9983	11120104001376	23.39122
TX03714	https://geoconnex.us/iow/demo/TX03714	34.68128	-102.0195	11120104001376	68.86861
TX06624	https://geoconnex.us/iow/demo/TX06624	34.61833	-100.2833	11120105000037	30.98668
TX03698	https://geoconnex.us/iow/demo/TX03698	35.00083	-100.8948	11120201000062	95.16322
TX02130	https://geoconnex.us/iow/demo/TX02130	35.21632	-100.8627	11120301001319	40.27132
TX03650	https://geoconnex.us/iow/demo/TX03650	35.30176	-101.2816	11120301000091	51.22846

2. Publish feature-level landing content with embedded JSON-LD and persistent identifiers

3. Publish your data so that each spatial feature has a website with:

    a. It's own URL

    b. A human-readable HTML version

    c. Machine-readable metadata formatted as JSON-LD

Why?

    Search engines can index and organize individual features!

"I want all water quality sample points from all organizations within this random polygon across two counties, but not any others"

2. Publish feature-level landing content with embedded JSON-LD and persistent identifiers

3. Publish your data so that each spatial feature has a website with:

   a. It's own URL

   b. A human-readable HTML version

   c. metadata formatted as JSON-LD

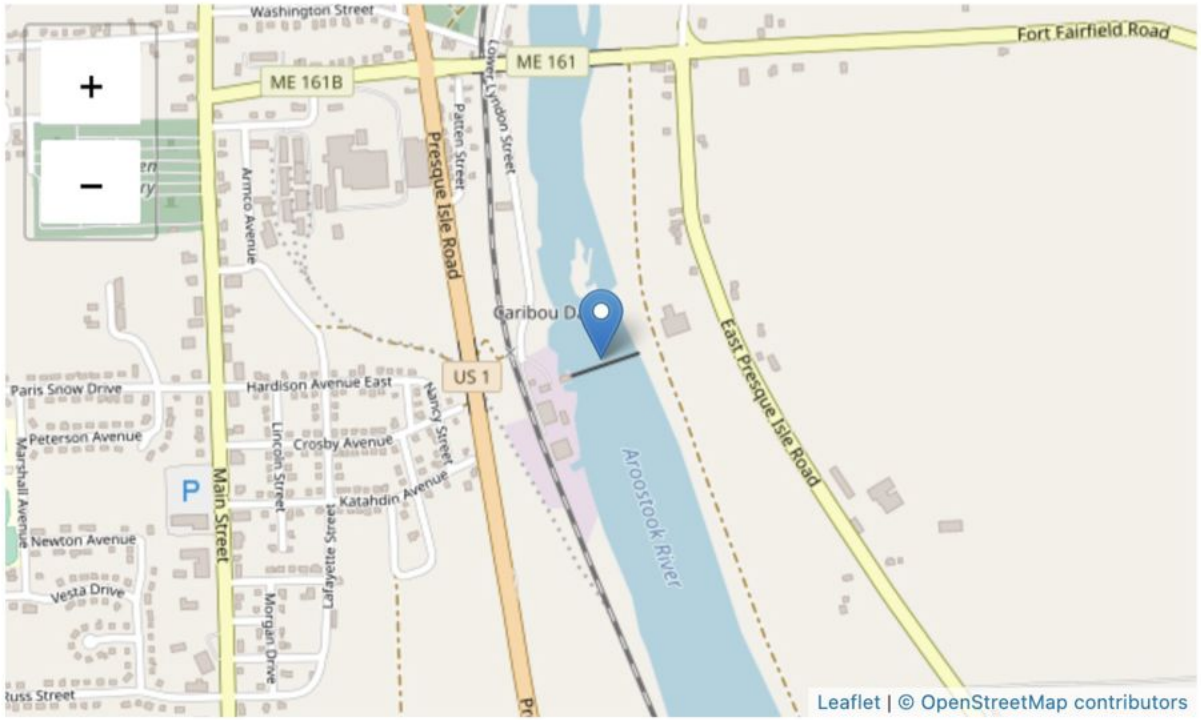
      standardized vocabularies for interoperability with other data

      links to common features (like NHD, states/counties/census tracts, etc.)

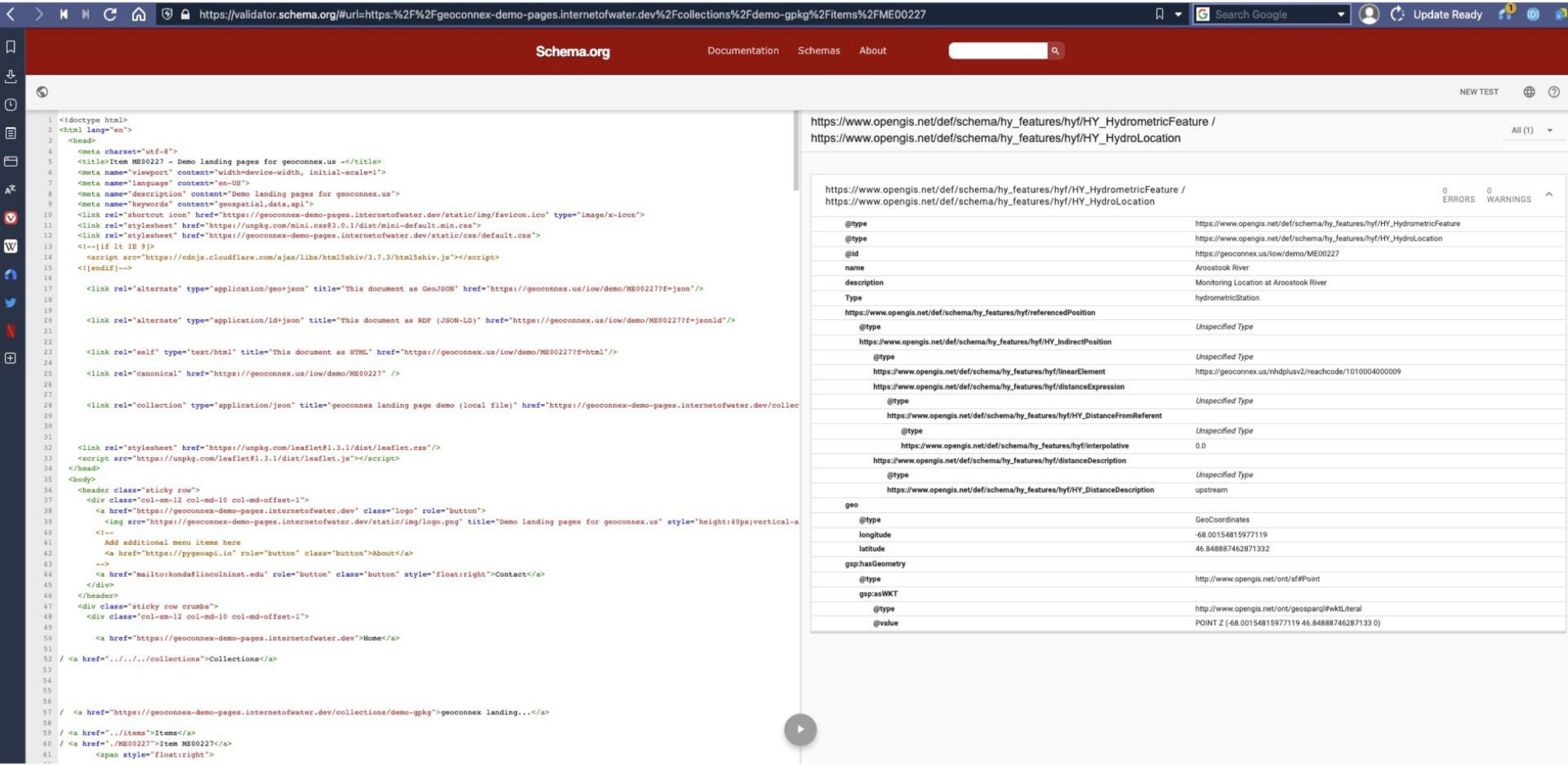
Example:

https://geoconnex-demo-pages.internetofwater.dev/collections/demo-gpkg/items/ME00227

Item ME00227



Property	Value
uri	https://geoconnex.us/iow/demo/ME002...
id	ME00227
fid	2
SourceAgency	None
SourceDataset	None
SourceFeatureURL	None
FeatureType	None
ReachCode	01010004000009
Measure	28.082673915760665

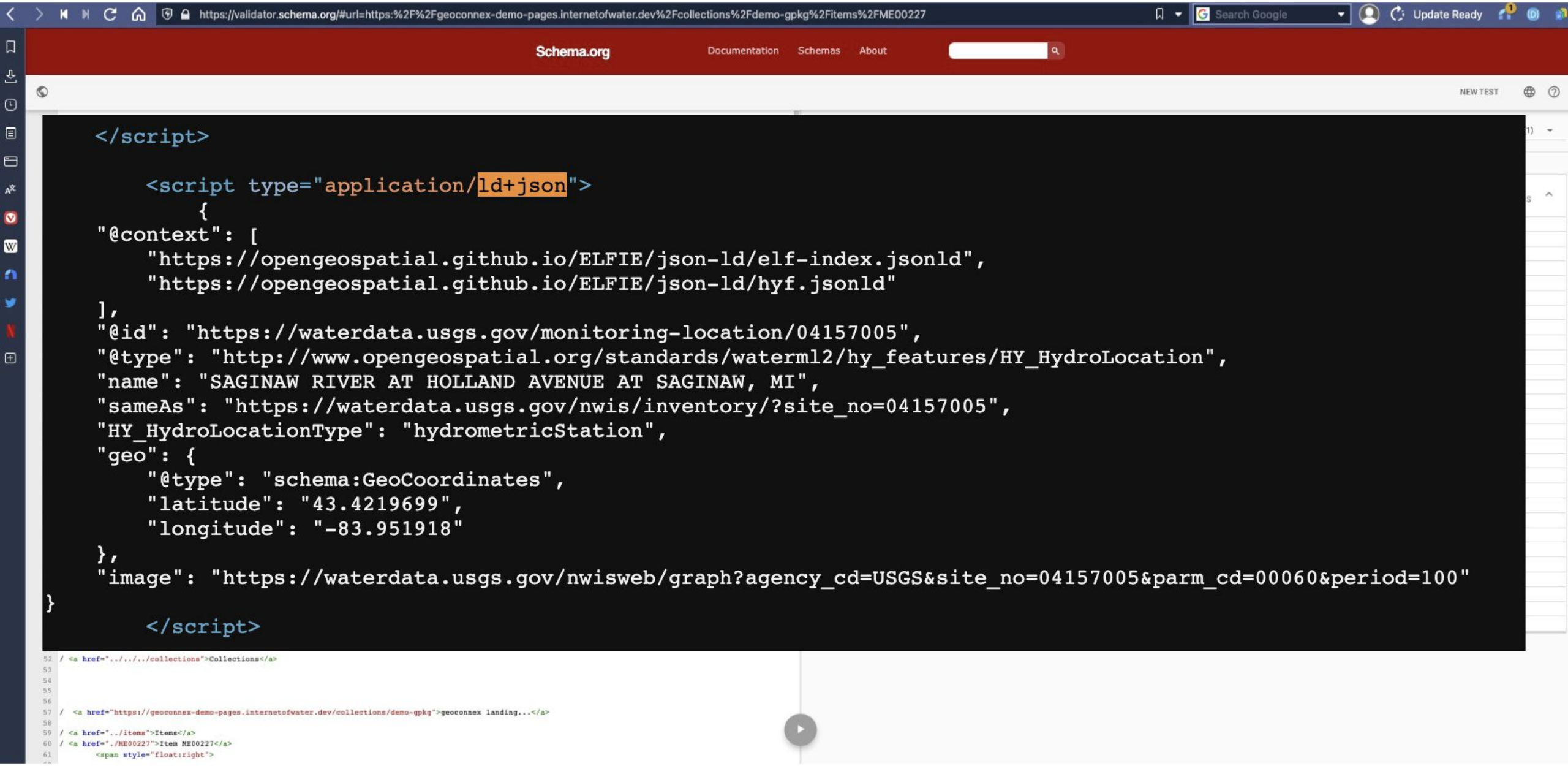

https://validator.schema.org/#url=https:%2F%2Fgeoconnex-demo-pages.internetofwater.dev%2Fcollections%2Fdemo-gpkg%2Fitems%2FME00227
Search Google
Update Ready
Schema.org
Documentation
Schemas
About
NEW TEST
<!doctype html>
<html lang="en">
<head>
<meta charset="utf-8">
<title>Item ME00227 - Demo landing pages for geoconnex.us -</title>
<meta name="viewport" content="width=device-width, initial-scale=1">
<meta name="language" content="en-US">
<meta name="description" content="Demo landing pages for geoconnex.us">
<meta name="keywords" content="geospatial,data,api">
<link rel="shortcut icon" href="https://geoconnex-demo-pages.internetofwater.dev/static/img/favicon.ico" type="image/x-icon">
<link rel="stylesheet" href="https://unpkg.com/mini.css@3.0.1/dist/mini-default.min.css">
<link rel="stylesheet" href="https://geoconnex-demo-pages.internetofwater.dev/static/css/default.css">
<!--[if lt IE 9]>
<script src="https://cdnjs.cloudflare.com/ajax/libs/html5shiv/3.7.3/html5shiv.js"></script>
<![endif]-->
<link rel="alternate" type="application/geo+json" title="This document as GeoJSON" href="https://geoconnex.us/iow/demo/ME00227?f=json"/>
<link rel="alternate" type="application/ld+json" title="This document as RDF (JSON-LD)" href="https://geoconnex.us/iow/demo/ME00227?f=jsonld"/>
<link rel="self" type="text/html" title="This document as HTML" href="https://geoconnex.us/iow/demo/ME00227?f=html"/>
<link rel="canonical" href="https://geoconnex.us/iow/demo/ME00227" />
<link rel="collection" type="application/json" title="geoconnex landing page demo (local file)" href="https://geoconnex-demo-pages.internetofwater.dev/collec
<link rel="stylesheet" href="https://unpkg.com/leaflet@1.3.1/dist/leaflet.css"/>
<script src="https://unpkg.com/leaflet@1.3.1/dist/leaflet.js"></script>
</head>
<body>
<header class="sticky row">

<a href="https://geoconnex-demo-pages.internetofwater.dev" class="logo" role="button">
<img src="https://geoconnex-demo-pages.internetofwater.dev/static/img/logo.png" title="Demo landing pages for geoconnex.us" style="height:40px;vertical-a
<!--
Add additional menu items here
About
-->
Contact

</header>

Home
/ Collections
/ geoconnex landing...
/ Items
/ Item ME00227

https://www.opengis.net/def/schema/hy_features/hyf/HY_HydrometricFeature /
https://www.opengis.net/def/schema/hy_features/hyf/HY_HydroLocation
All (1)
https://www.opengis.net/def/schema/hy_features/hyf/HY_HydrometricFeature /
https://www.opengis.net/def/schema/hy_features/hyf/HY_HydroLocation
0 ERRORS
0 WARNINGS
@type https://www.opengis.net/def/schema/hy_features/hyf/HY_HydrometricFeature
@type https://www.opengis.net/def/schema/hy_features/hyf/HY_HydroLocation
@id https://geoconnex.us/iow/demo/ME00227
name Aroostook River
description Monitoring Location at Aroostook River
Type hydrometricStation
https://www.opengis.net/def/schema/hy_features/hyf/referencedPosition
@type Unspecified Type
https://www.opengis.net/def/schema/hy_features/hyf/HY_IndirectPosition
@type Unspecified Type
https://www.opengis.net/def/schema/hy_features/hyf/linearElement https://geoconnex.us/nhdplusv2/reachcode/1010004000009
https://www.opengis.net/def/schema/hy_features/hyf/distanceExpression
@type Unspecified Type
https://www.opengis.net/def/schema/hy_features/hyf/HY_DistanceFromReferent
@type Unspecified Type
https://www.opengis.net/def/schema/hy_features/hyf/interpolative 0.0
https://www.opengis.net/def/schema/hy_features/hyf/distanceDescription
@type Unspecified Type
https://www.opengis.net/def/schema/hy_features/hyf/HY_DistanceDescription upstream
geo
@type GeoCoordinates
longitude -68.00154815977119
latitude 46.848887462871332
gsp:hasGeometry
@type http://www.opengis.net/ont/sf#Point
gsp:asWKT
@type http://www.opengis.net/ont/geosparql#wktLiteral
@value POINT Z (-68.00154815977119 46.84888746287133 0)


https://validator.schema.org/#url=https:%2F%2Fgeoconnex-demo-pages.internetofwater.dev%2Fcollections%2Fdemo-gpkg%2Fitems%2FME00227
Search Google
Update Ready
Schema.org
Documentation
Schemas
About
NEW TEST
</script>
<script type="application/ld+json">
{
"@context": [
"https://opengeospatial.github.io/ELFIE/json-ld/elf-index.jsonld",
"https://opengeospatial.github.io/ELFIE/json-ld/hyf.jsonld"
],
"@id": "https://waterdata.usgs.gov/monitoring-location/04157005",
"@type": "http://www.opengeospatial.org/standards/waterml2/hy_features/HY_HydroLocation",
"name": "SAGINAW RIVER AT HOLLAND AVENUE AT SAGINAW, MI",
"sameAs": "https://waterdata.usgs.gov/nwis/inventory/?site_no=04157005",
"HY_HydroLocationType": "hydrometricStation",
"geo": {
"@type": "schema:GeoCoordinates",
"latitude": "43.4219699",
"longitude": "-83.951918"
},
"image": "https://waterdata.usgs.gov/nwisweb/graph?agency_cd=USGS&site_no=04157005&parm_cd=00060&period=100"
}
</script>
/ Collections
/ geoconnex landing...
/ Items
/ Item ME00227

1)

https://www.opengis.net/def/schema/hy_features/hyf/HY_HydrometricFeature /
https://www.opengis.net/def/schema/hy_features/hyf/HY_HydroLocation

0 ERRORS 0 WARNINGS

@type	https://www.opengis.net/def/schema/hy_features/hyf/HY_HydrometricFeature
@type	https://www.opengis.net/def/schema/hy_features/hyf/HY_HydroLocation
@id	https://geoconnex.us/iow/demo/ME00227
name	Aroostook River
description	Monitoring Location at Aroostook River
Type	hydrometricStation
https://www.opengis.net/def/schema/hy_features/hyf/referencedPosition	
@type	*Unspecified Type*
https://www.opengis.net/def/schema/hy_features/hyf/HY_IndirectPosition	
@type	*Unspecified Type*
https://www.opengis.net/def/schema/hy_features/hyf/linearElement	https://geoconnex.us/nhdplusv2/reachcode/1010004000009
https://www.opengis.net/def/schema/hy_features/hyf/distanceExpression	
@type	*Unspecified Type*
https://www.opengis.net/def/schema/hy_features/hyf/HY_DistanceFromReferent	
@type	*Unspecified Type*
https://www.opengis.net/def/schema/hy_features/hyf/interpolative	0.0
https://www.opengis.net/def/schema/hy_features/hyf/distanceDescription	
@type	*Unspecified Type*
https://www.opengis.net/def/schema/hy_features/hyf/HY_DistanceDescription	upstream
geo	
@type	GeoCoordinates
longitude	-68.00154815977119
latitude	46.848887462871332
gsp:hasGeometry	
@type	http://www.opengis.net/ont/sf#Point
gsp:asWKT	
@type	http://www.opengis.net/ont/geosparql#wktLiteral
@value	POINT Z (-68.00154815977119 46.84888746287133 0)

What to put in JSON-LD?

- Templates: https://docs.geoconnex.us/participating.html#templates

  - ”@id” : “https://geoconnex.us/iow/demo/TX14456”
  - “@type”: https://www.opengis.net/def/schema/hy_features/hyf/HY_HydrometricFeature
  - “https://schema.org/name” : “Site 14556”
  - “https://schema.org/description” : “Sampling site on Rock Creek near New Hope Bridge”
  - “https://schema.org/geoWithin”: “https://geoconnex.us/ref/states/48”
  - **"hyf:referencedPosition": [{ "hyf:HY_IndirectPosition": { "hyf:distanceExpression": { "hyf:HY_DistanceFromReferent": { "hyf:interpolative": 35 } }, "hyf:distanceDescription": { "hyf:HY_DistanceDescription": “upstream”}, "hyf:linearElement": ”https://geoconnex.us/nhdplushr/reachcode/121432425”} }**

2. Publish feature-level landing content with embedded JSON-LD and persistent identifiers

- How?
  - Templating systems: https://en.wikipedia.org/wiki/Web_template_system
  - Turnkey solution:
    - Pygeoapi: https://pygeoapi.io
      - Internet of Water version: https://github.com/internetofwater/pygeoapi
        - Docker image: internetofwater/pygeoapi:stable
        - Can generate landing pages and JSON-LD from:
          - csv, geojson, shp, geopackage/SQLite
          - PostGIS
          - OGC WFS
          - ESRI FeatureServer/MapServer

https://geoconnex-demo-pages.internetofwater.dev/collections

3. Mint persistent identifiers with https://geoconnex.us

- Like a URL shortener, for your features!

- https://geoconnex.us/your-org/123 -> 303 redirect ->

https://yourorg.com/sites/123

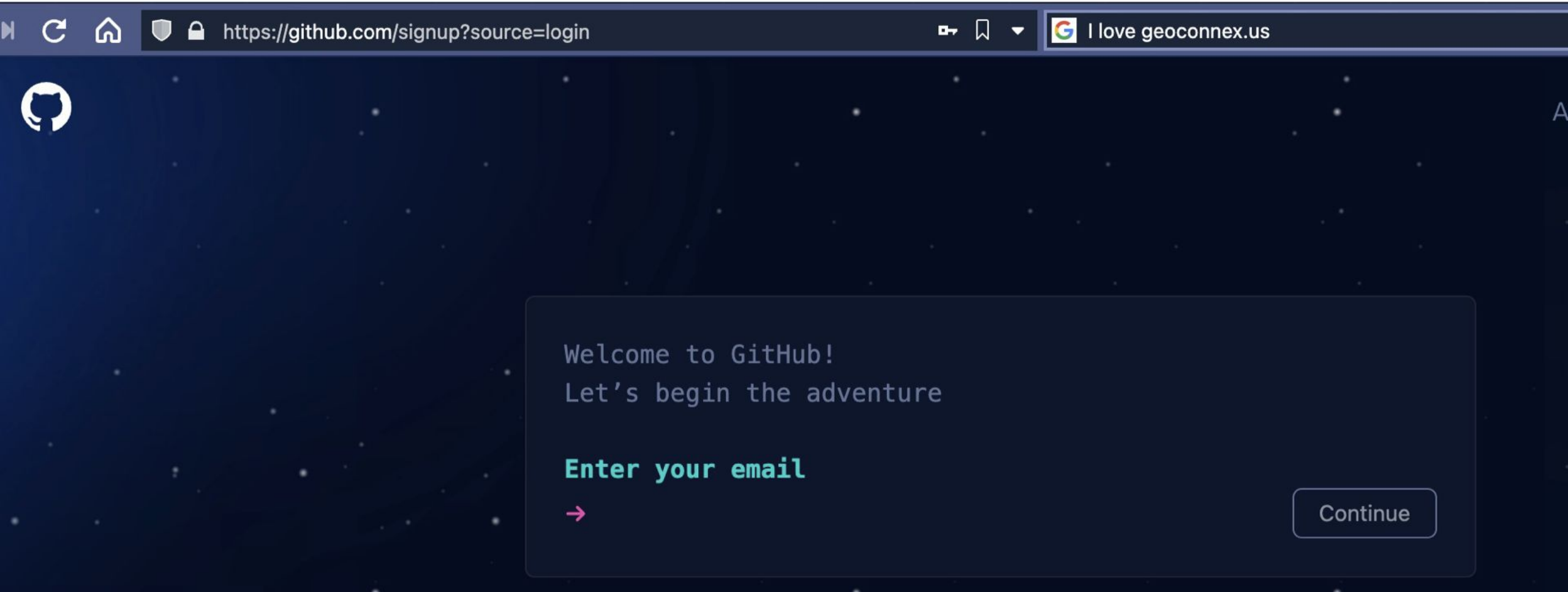
or

https://yourorg-newwebsite.com/api?site=123

or …

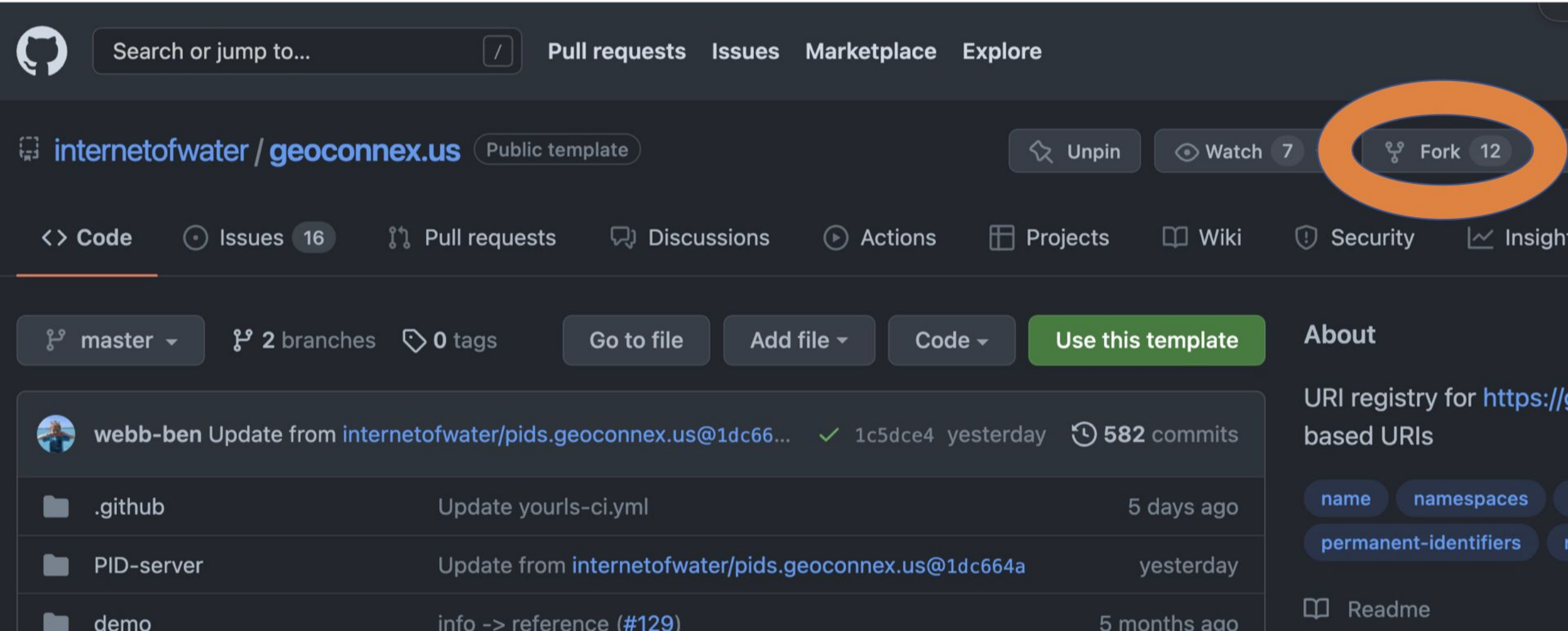
3. Mint persistent identifiers with https://geoconnex.us

- Step 0: Create a Github account



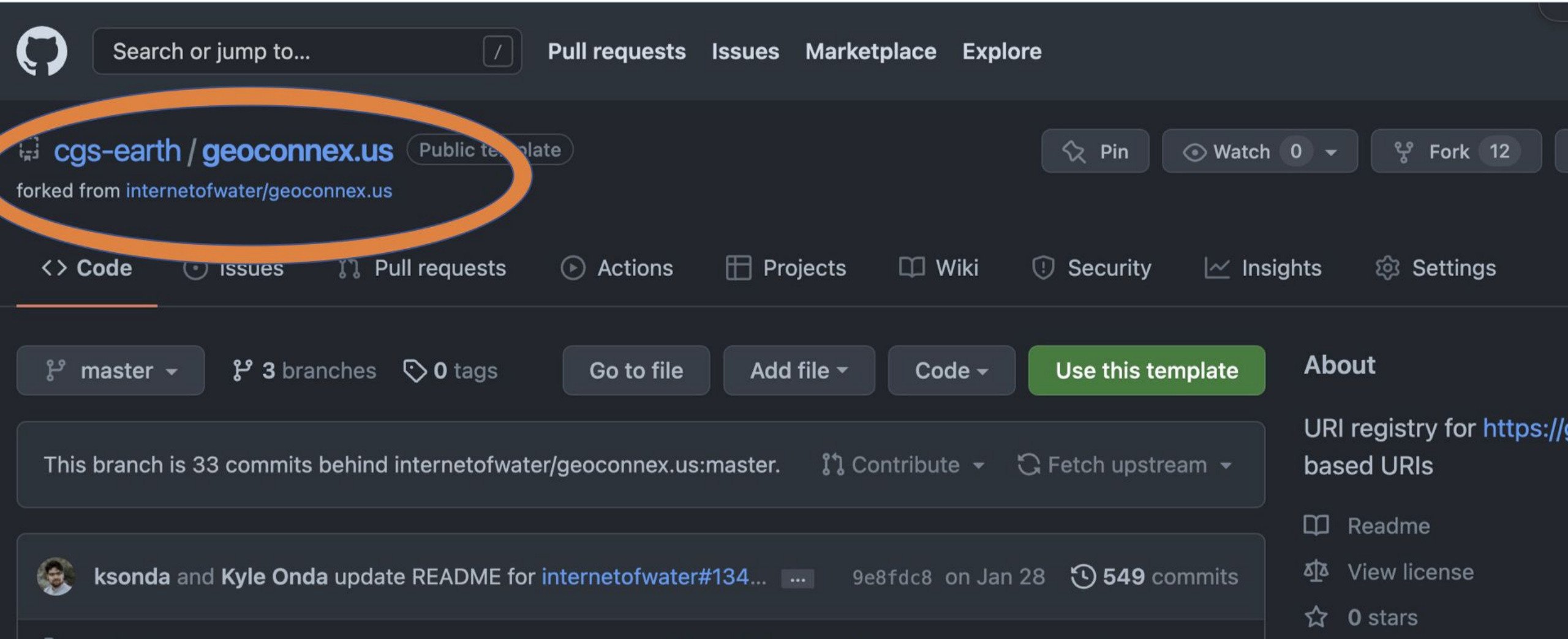
3. Mint persistent identifiers with https://geoconnex.us

- Step 1: Fork the repository: https://github.com/internetofwater/geoconnex.us



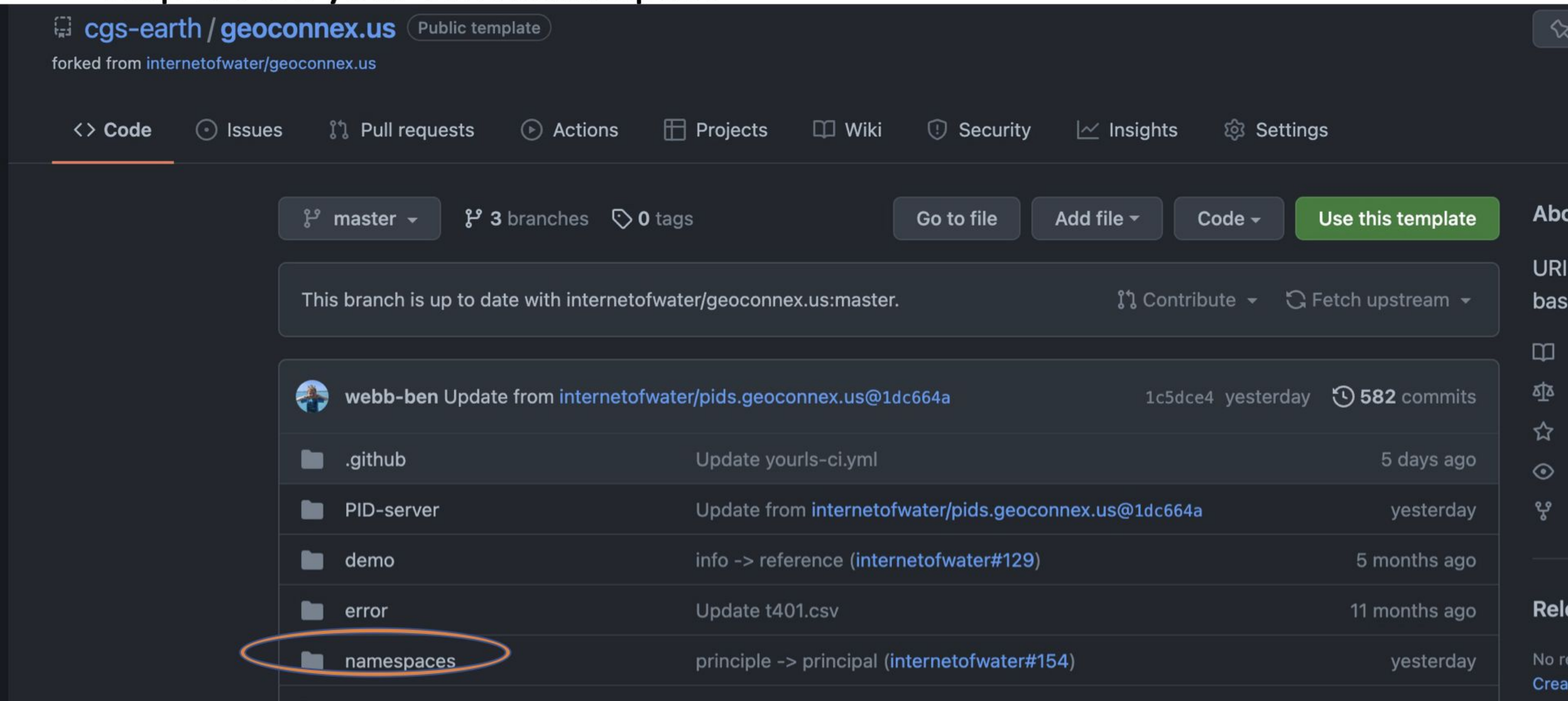
3. Mint persistent identifiers with https://geoconnex.us

- Step 1: Fork the repository: https://github.com/internetofwater/geoconnex.us



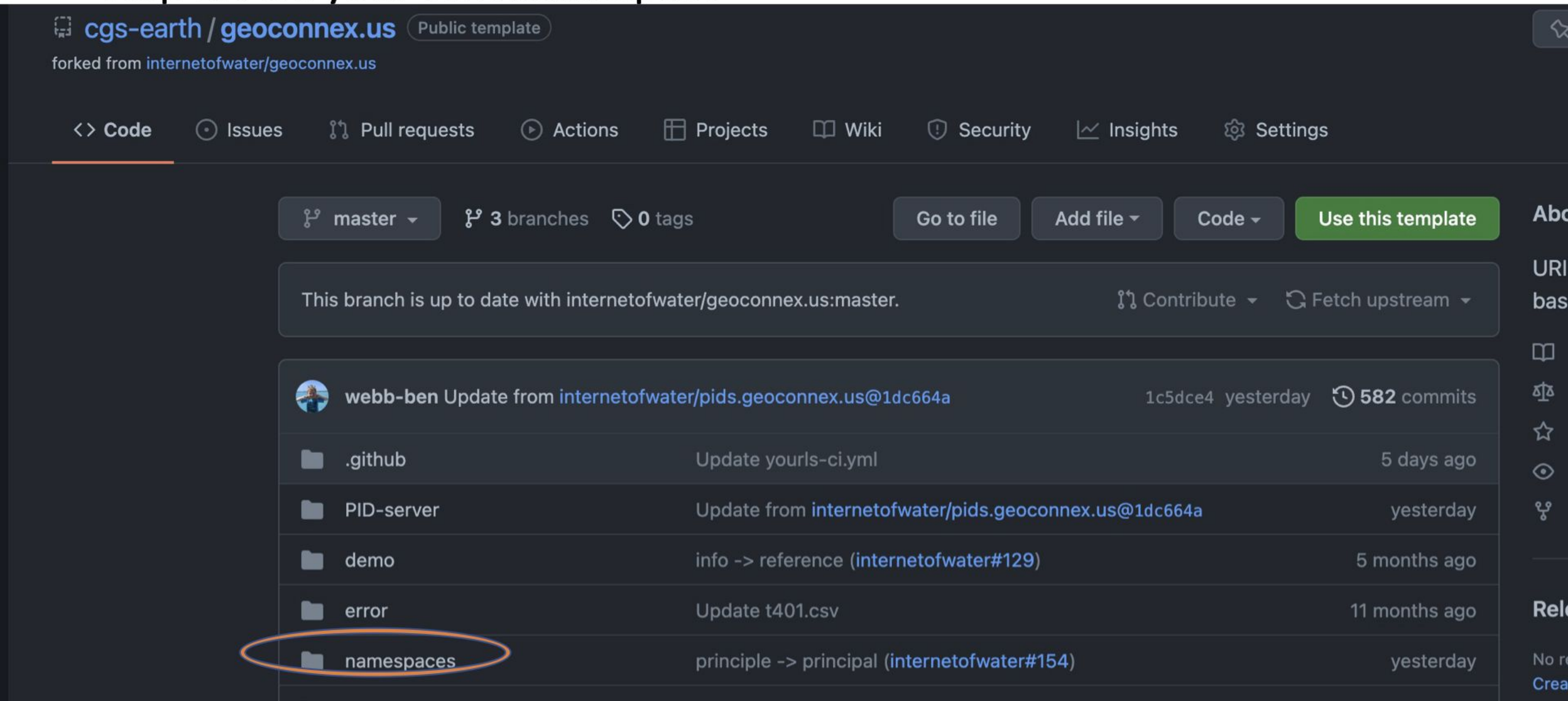
3. Mint persistent identifiers with https://geoconnex.us

- Step 2: Add your own namespace



3. Mint persistent identifiers with https://geoconnex.us

- Step 2: Add your own namespace



ksonda Update README.md Latest commit 9d95540 2 minutes ago

1 contributor

17 lines (10 sloc) | 453 Bytes Raw Blame

Internet of Water

Homepage:

- https://internetofwater.org/

These mappings are of two kinds:

1. temporary, experimental resources hosted by the Internet of Water organization for the purposes of testing geoconnex.us infrastructure.
2. (meta)data resources curated directly by the Internet of Water organization.

This collection will evolve over time, with experimental PIDs being retired as appropriate.

Contacts:

- konda@lincolninst.edu

3. Mint persistent identifiers with https://geoconnex.us

- **Step 3: Create a csv in the following format**

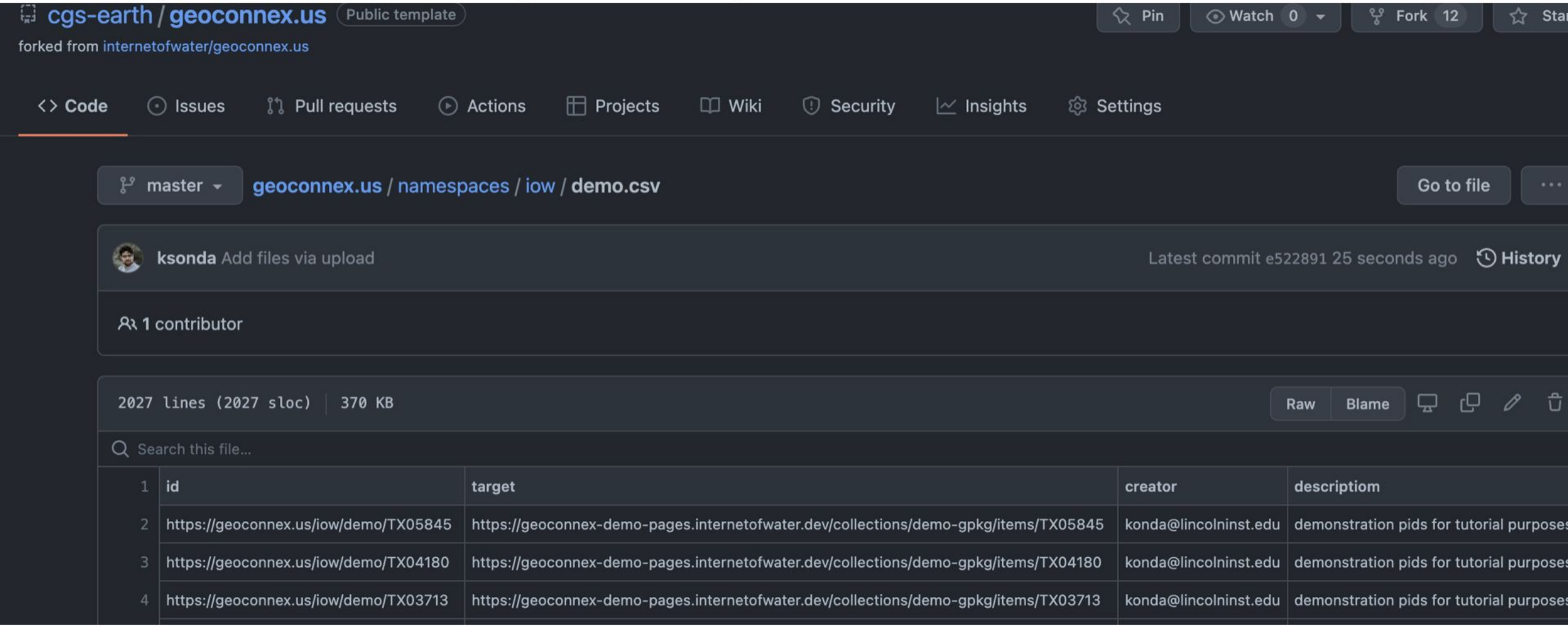
The persistent ID for each feature

The URL for the landing page you want the ID to redirect to

	A	B	C	D
1	id	target	creator	descriptiom
2	https://geoconnex.us/iow/demo/TX05845	https://geoconnex-demo-pages.internetofwater.dev/collections/demo-gpkg/items/TX05845	konda@linco	demonstratio
3	https://geoconnex.us/iow/demo/TX04180	https://geoconnex-demo-pages.internetofwater.dev/collections/demo-gpkg/items/TX04180	konda@linco	demonstratio
4	https://geoconnex.us/iow/demo/TX03713	https://geoconnex-demo-pages.internetofwater.dev/collections/demo-gpkg/items/TX03713	konda@linco	demonstratio
5	https://geoconnex.us/iow/demo/TX03714	https://geoconnex-demo-pages.internetofwater.dev/collections/demo-gpkg/items/TX03714	konda@linco	demonstratio
6	https://geoconnex.us/iow/demo/TX06624	https://geoconnex-demo-pages.internetofwater.dev/collections/demo-gpkg/items/TX06624	konda@linco	demonstratio
7	https://geoconnex.us/iow/demo/TX03698	https://geoconnex-demo-pages.internetofwater.dev/collections/demo-gpkg/items/TX03698	konda@linco	demonstratio
8	https://geoconnex.us/iow/demo/TX02130	https://geoconnex-demo-pages.internetofwater.dev/collections/demo-gpkg/items/TX02130	konda@linco	demonstratio
9	https://geoconnex.us/iow/demo/TX03650	https://geoconnex-demo-pages.internetofwater.dev/collections/demo-gpkg/items/TX03650	konda@linco	demonstratio
10	https://geoconnex.us/iow/demo/TX00775	https://geoconnex-demo-pages.internetofwater.dev/collections/demo-gpkg/items/TX00775	konda@linco	demonstratio
11	https://geoconnex.us/iow/demo/TX00579	https://geoconnex-demo-pages.internetofwater.dev/collections/demo-gpkg/items/TX00579	konda@linco	demonstratio
12	https://geoconnex.us/iow/demo/OK00452	https://geoconnex-demo-pages.internetofwater.dev/collections/demo-gpkg/items/OK00452	konda@linco	demonstratio

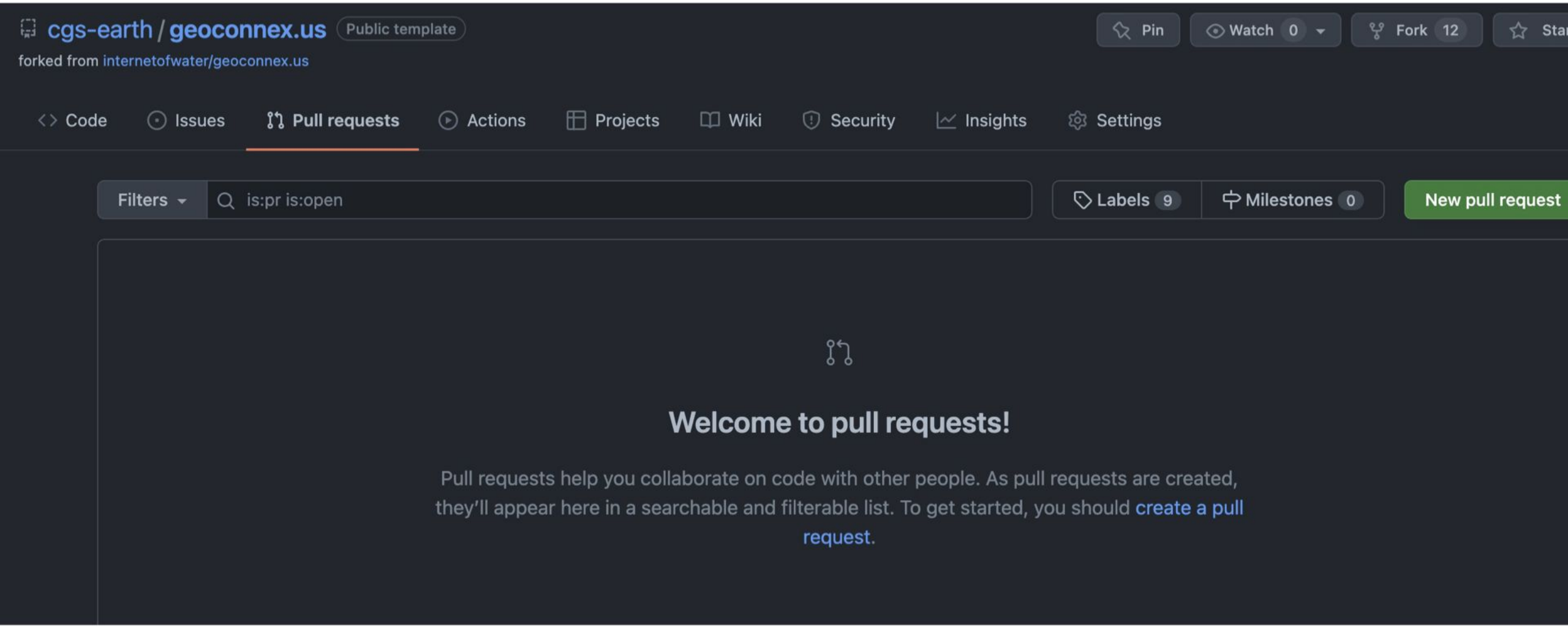
3. Mint persistent identifiers with https://geoconnex.us

- Step 4: Add the csv to your namespace folder



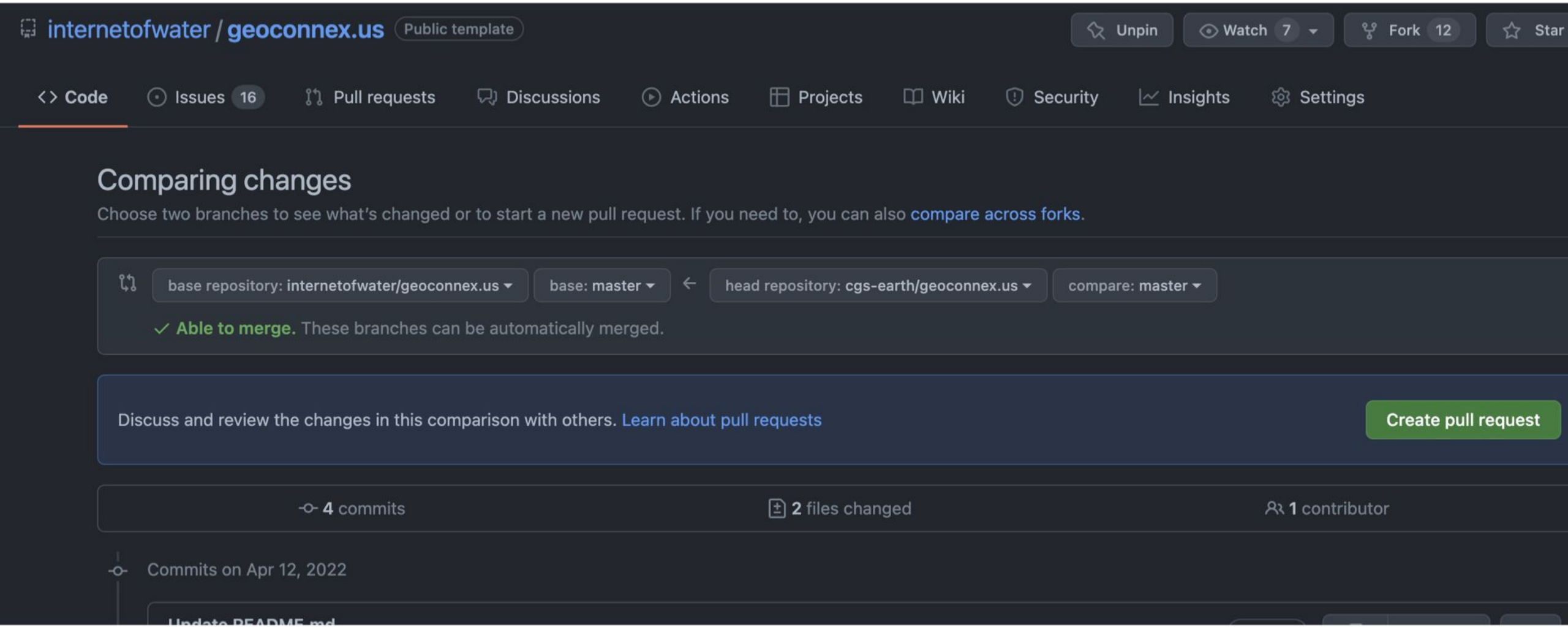
3. Mint persistent identifiers with https://geoconnex.us

- Step 5: Open a pull request to the main repository



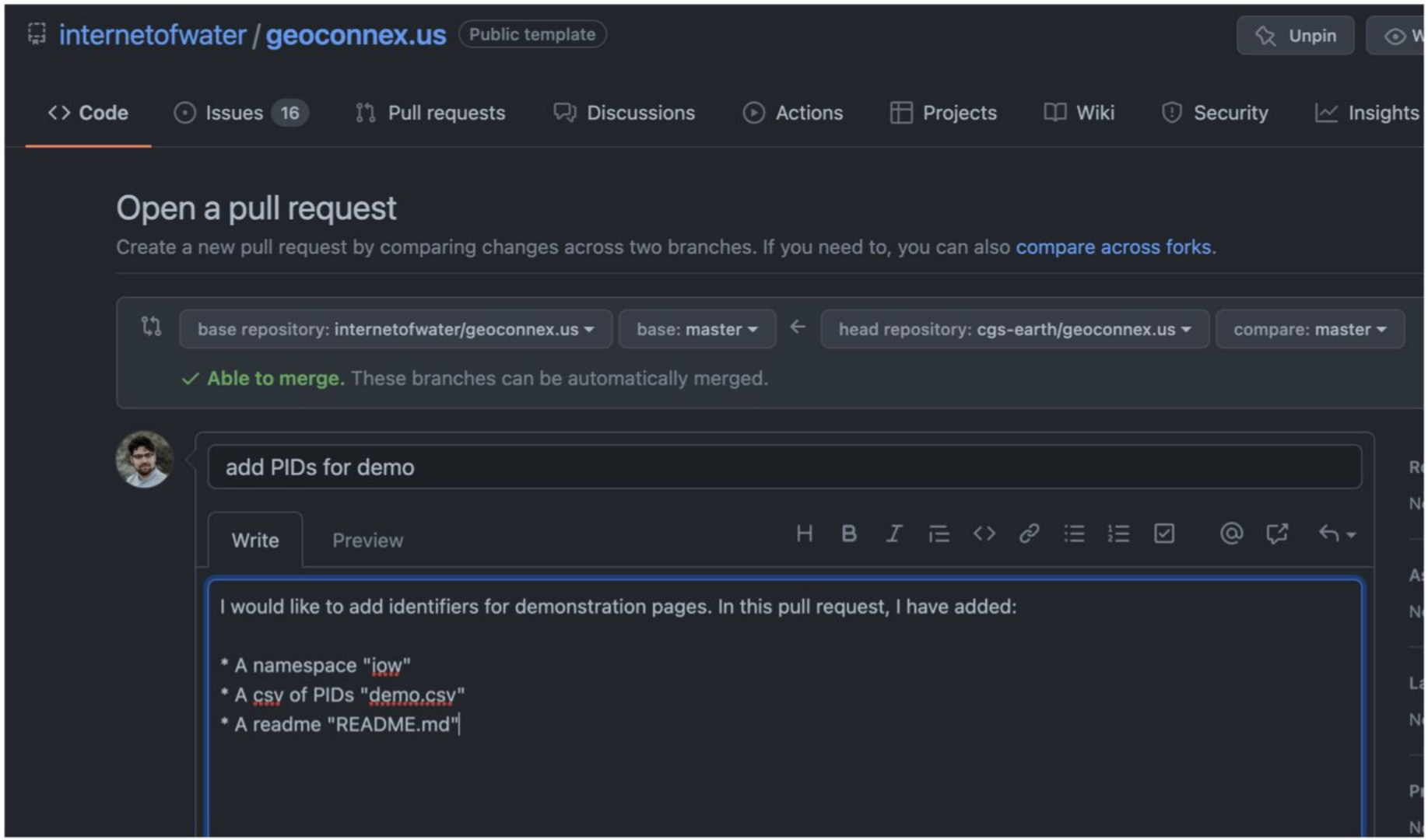
3. Mint persistent identifiers with https://geoconnex.us

- Step 5: Open a pull request to the main repository



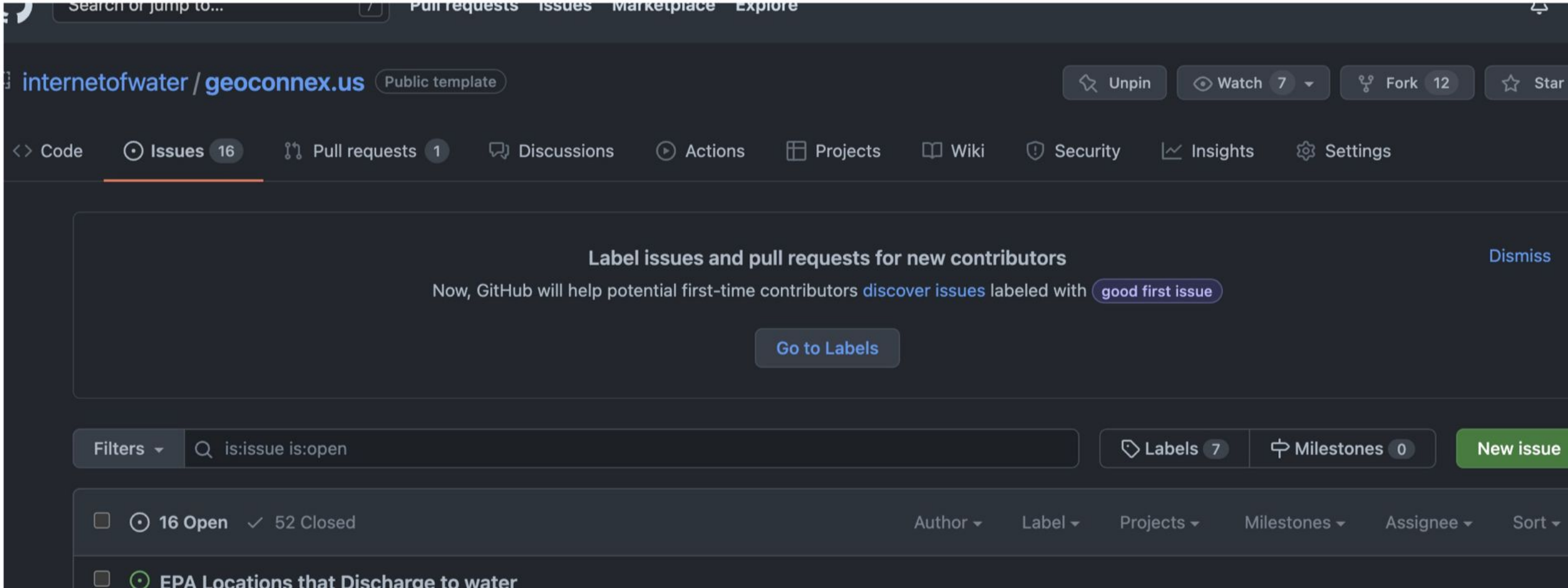
3. Mint persistent identifiers with https://geoconnex.us

- Step 5: Open a pull request to the main repository



3. Mint persistent identifiers with https://geoconnex.us

- Step 6: Wait for your pull request to be approved
- Alternative to Steps 1-6: Open an Issue and ask the geoconnex.us team to help you directly!



3. M…nex.us

- Ste…
- Alt…
  tea…

internetofwater / geoconnex.us Public template

Unpin Watch

Code | Issues 16 | Pull requests 1 | Discussions | Actions | Projects | Wiki | Security | Insights

Issue: Request regex redirect

Describe this issue template's purpose here. If this doesn't look right, choose a different type.

[regex redirect request]

Write | Preview

```
## Contact Information
Your name: Kyle Onda

Your email: konda@lincolninst.edu

Your organization: Lincoln Institute

Your organization website: https://lincolninst.edu

## redirect request details

I would like to mint PIDs for my demo pages please help me.
```

Attach files by dragging & dropping, selecting or pasting them.

Styling with Markdown is supported

Submit new issue

Remember, contributions to this repository should follow its contributing guidelines.

3. Mint persistent identifiers with https://geoconnex.us

- Step 7: Try your PIDs!

https://geoconnex.us/iow/demo/TX05845

Now let’s contribute data to the NLDI

4. Publish a geojson file with your hydro-addressed location data

- The NLDI requires a geojson (POINT geometry) file accessible from a URL (API or data repository) with at least columns that include the following concepts
  - id: a unique alphanumeric identifier for the feature within the file
  - uri: url pointing to a particular feature web resource where more information can be found (this can be a geoconnex PID)
  - name: name for the feature
  - Reach (optional): the NHD reachcode from the feature's hydrologic address (NHDPlusV2 for now, NHDHR coming)
  - Measure (optional): the measure along the reachcode from the hydrologic address

4. Publish a geojson file with your hydro-addressed location data

- Option 1: URL for GeoJSON output from a web service
  - NOTE: No pagination allowed (e.g., only <2,000 features for ESRI FeatureServer)
  - NOTE: Ensure output is in WGS84 CRS
  - NOTE: Endpoint must be publicly available (no authentication)
  - Examples:
    - ESRI Feature Service: https://services5.arcgis.com/9b85MAhVnAUWydgW/ArcGIS/rest/services/data/FeatureServer/0/query?where=1%3D1&outFields=*&outSR=4326&f=pgeojson
    - Pygeoapi (same as internet of water landing page generator):
    - https://geoconnex-demo-pages.internetofwater.dev/collections/demo-gpkg/items?f=json&limit=10000

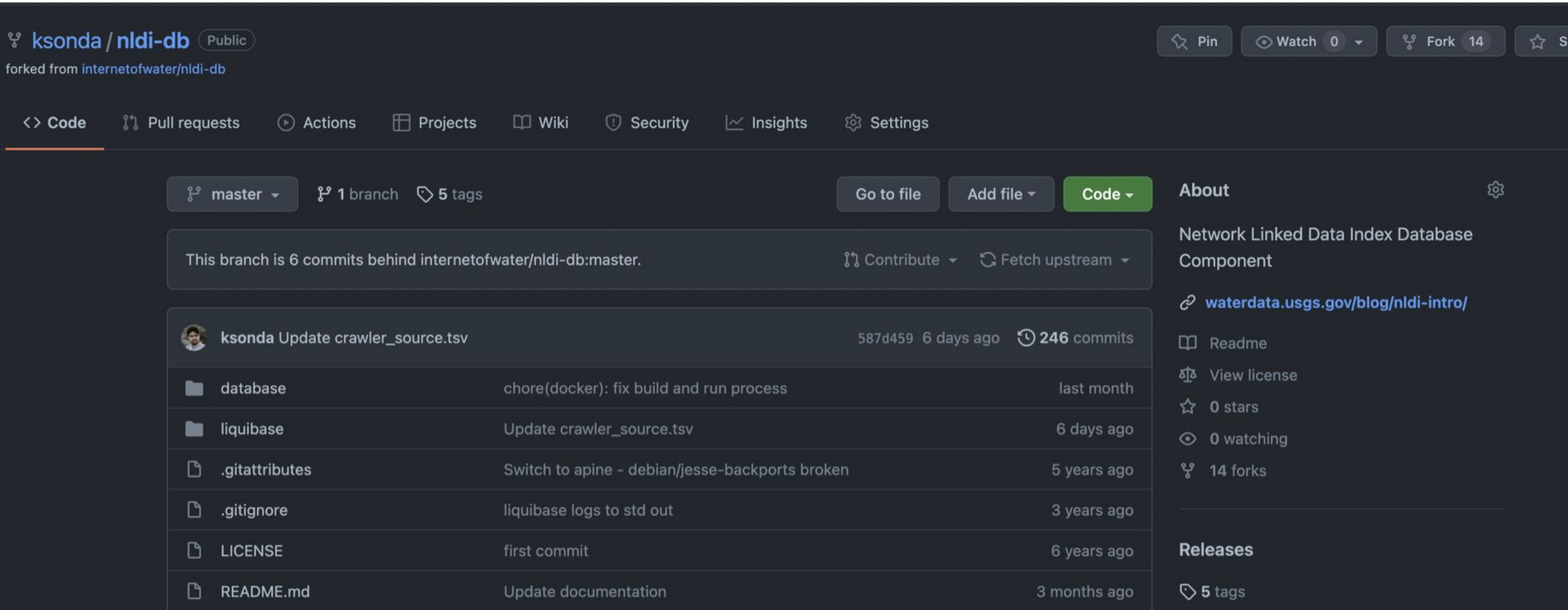
4. Publish a geojson file with your hydro-addressed location data

- Option 2 (>2,000 features or so): Create a separate geojson file with the fields, and place at a publicly available location with a http(s) URL (NO AUTHENTICATION). Examples:
  - CUAHSI Hydroshare
  - University dataverse
  - USGS ScienceBase
  - Personal website
  - Github (if < 100MB)
  - ESRI ArcGIS Online ”Content” :
    - https://lincolninstitute.maps.arcgis.com/home/item.html?id=89f9aa64d7ff47dd8bd2548385f3bc02
    - https://lincolninstitute.maps.arcgis.com/sharing/rest/content/items/89f9aa64d7ff47dd8bd2548385f3bc02/data

5. Register your geojson file with the NLDI repository

- **Step 1: Fork github repository:**

https://github.com/internetofwater/nldi-db



5. Register your geojson file with the NLDI repository

- Step 2: Update NLDI dataset registry:

master / nldi-db / liquibase / changeLogs / nldi / nldi_data / update_crawler_source / **crawler_source.tsv**

Go to file ···

dblodgett-usgs update links for usgs sources — Latest commit dcd1c1c on Mar 10 — History

3 contributors

11 lines (11 sloc) | 2.23 KB — Raw | Blame

Search this file...

	crawler_source_id	source_name	source_suffix	source_uri
2	2	HUC12 Pour Points	huc12pp	https://www.sciencebase.gov/catalogMaps/mapping/ows/57336b02e4b0dae0d5dd619a?service=WFS&version=1.0.0&re
3	1	Water Quality Portal	WQP	https://www.waterqualitydata.us/data/Station/search?mimeType=geojson&minactivities=1&counts=no
4	5	NWIS Surface Water Sites	nwissite	https://www.sciencebase.gov/catalog/file/get/60c7b895d34e86b9389b2a6c?name=usgs_nldi_gages.geojson
5	6	Water Data Exchange 2.0 Sites	wade	https://www.hydroshare.org/resource/5f665b7b82d74476930712f7e423a0d2/data/contents/wade.geojson
6	7	geoconnex.us reference gages	ref_gage	https://www.hydroshare.org/resource/4a22e88e689949afa1cf71ae009eaf1b/data/contents/nldi_gages.geojson
7	8	Streamgage catalog for CA SB19	ca_gages	https://sb19.linked-data.internetofwater.dev/collections/ca_gages/items?f=json&limit=10000
8	9	USGS Geospatial Fabric V1.1 Points of Interest	gfv11_pois	https://www.sciencebase.gov/catalogMaps/mapping/ows/609c8a63d34ea221ce3acfd3?service=WFS&version=1.0.0&re
9	10	Vigil Network Data	vigil	https://www.sciencebase.gov/catalog/file/get/60c7b895d34e86b9389b2a6c?name=vigil.geojson

5. Register your geojson file with the NLDI repository

- Step 2: Update NLDI dataset registry, map geojson attributes to registry fields:

master / nldi-db / liquibase / changeLogs / nldi / nldi_data / update_crawler_source / **crawler_source.tsv** — Go to file

dblodgett-usgs update links for usgs sources — Latest commit dcd1c1c on Mar 10 — History

3 contributors

11 lines (11 sloc) | 2.23 KB — Raw | Blame

Search this file...

	feature_id	feature_name	feature_uri	feature_reach	feature_measure	ingest_type	feature_type
rsName=EPSG:4326&typeName=sb:fpp&outputFormat=json	HUC_12	HUC_12	HUC_12	NULL	NULL	point	hydrolocation
	MonitoringLocationIdentifier	MonitoringLocationName	siteUrl	NULL	NULL	point	varies
	provider_id	name	subjectOf	nhdpv2_REACHCODE	nhdpv2_REACH_measure	reach	hydrolocation
	feature_id	feature_name	feature_uri	NULL	NULL	point	varies
	id	name	subjectOf	nhdpv2_REACHCODE	nhdpv2_REACH_measure	reach	hydrolocation
	site_id	sitename	uri	rchcd_medres	reach_measure	reach	hydrolocation
sName=EPSG:4326&typeName=sb::gfv11&outputFormat=json	prvdr_d	name	uri	n2_REACHC	n2_REACH_	reach	hydrolocation
	SBID	Site Name	SBURL	nhdpv2_REACHCODE	nhdpv2_REACH_measure	reach	hydrolocation
	provider_id	name	subjectOf	NULL	NULL	point	point

5. Register your geojson file with the NLDI repository

- **Step 2: Update NLDI dataset registry, map geojson attributes to registry fields:**

https://github.com/ksonda/nldi-db/commit/0b36df17a67a71d3c490e2ab5408d0a4fcf5f65c#diff-7dce4ef6fadf7baa6c6a3309d25413215e43b79cd7795d63c972da88096adc5e

5. Register your geojson file with the NLDI repository

- **Step 3: Open Pull Request with your contribution**

https://github.com/ksonda/nldi-db/commit/0b36df17a67a71d3c490e2ab5408d0a4fcf5f65c#diff-7dce4ef6fadf7baa6c6a3309d25413215e43b79cd7795d63c972da88096adc5e