DIGITAL MAPPING TECHNIQUES 2014

The following was presented at DMT'14
(June 1-4, 2014 - Delaware Geological Survey,
Newark, DE)

The contents of this document are provisional

See Presentations and Proceedings
from the DMT Meetings (1997-2014)

http://ngmdb.usgs.gov/info/dmt/

Metadata, Maps and More: Delaware's Participation in the USGIN

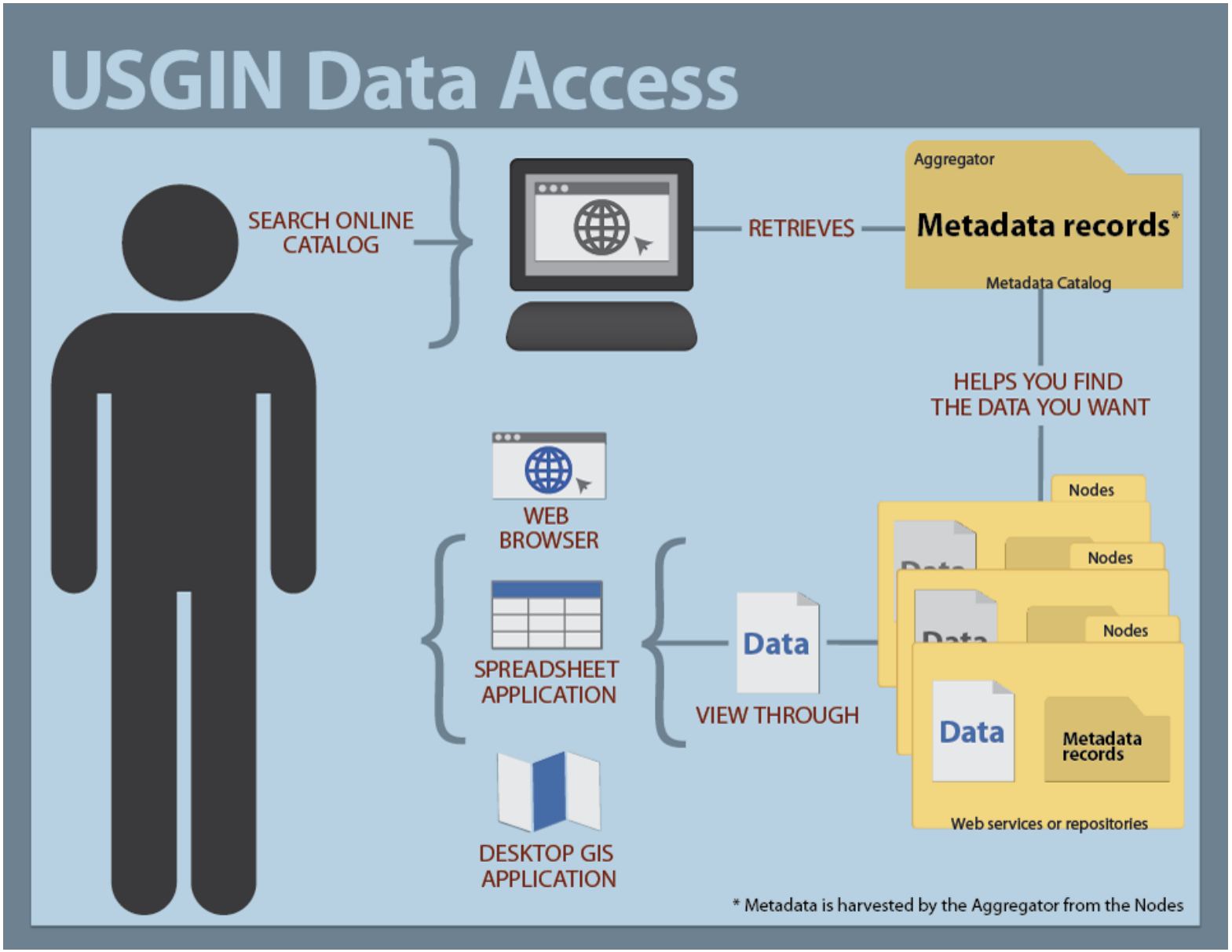
John Callahan
Delaware Geological Survey

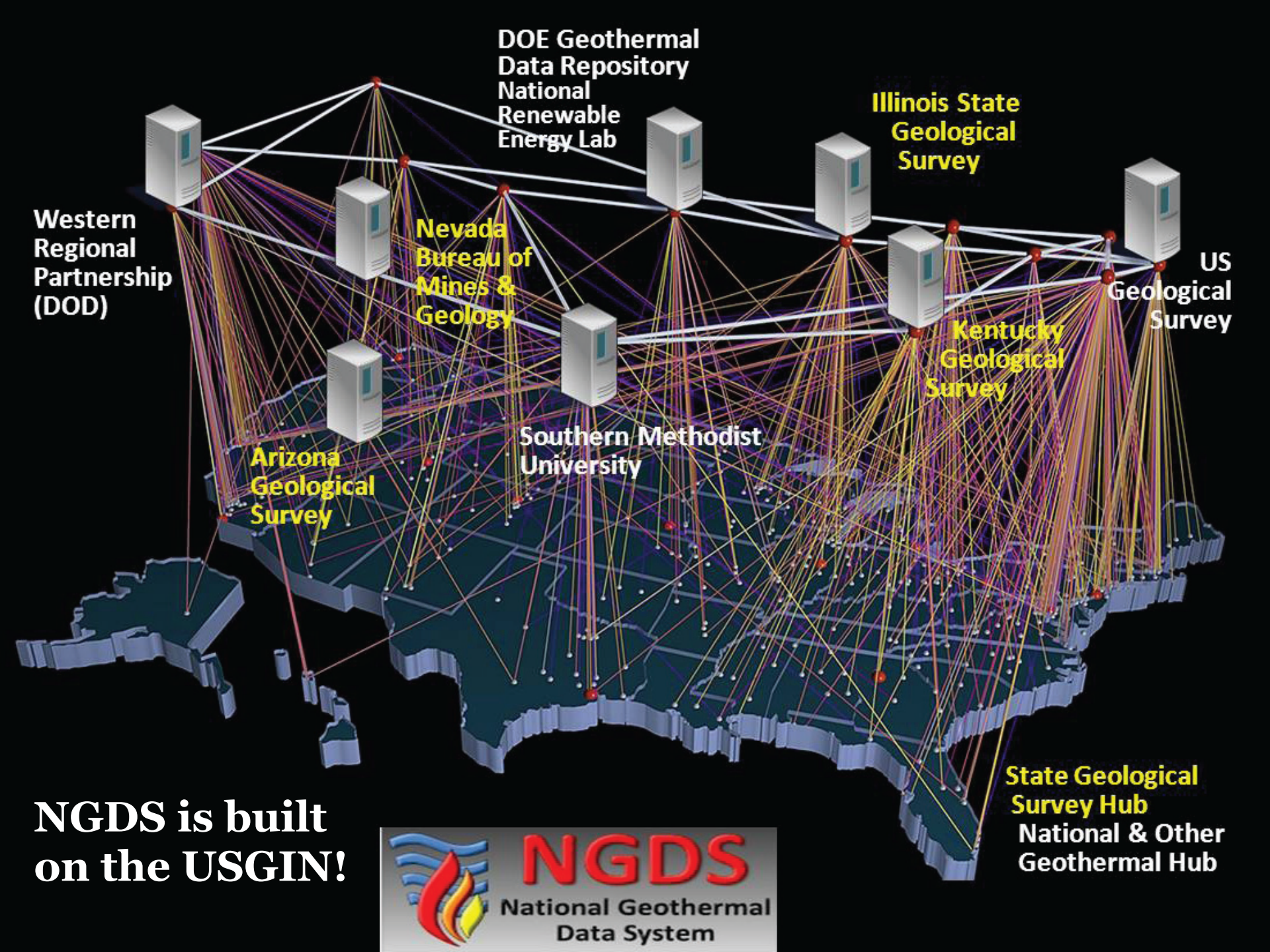
Agenda

- Becoming a USGIN node for Delaware
  - Server configuration
  - Metadata editing
  - GeoSciML-Portrayal
  - WMS and WFS mapping services
- Publication to OneGeology
- Delaware Geologic Information Resource (DGIR)
- Next Steps…

U.S. Geoscience Information Network

- USGIN facilitates access to publicly available geoscience data from state, federal and private sources.
- Provides open, interoperable specifications and a web-based central harvesting mechanism for participants.


USGIN Data Access
SEARCH ONLINE CATALOG
RETRIEVES
Aggregator
Metadata records*
Metadata Catalog
HELPS YOU FIND THE DATA YOU WANT
WEB BROWSER
SPREADSHEET APPLICATION
DESKTOP GIS APPLICATION
Data
VIEW THROUGH
Nodes
Nodes
Nodes
Data
Metadata records
Web services or repositories
* Metadata is harvested by the Aggregator from the Nodes


DOE Geothermal Data Repository National Renewable Energy Lab
Illinois State Geological Survey
Western Regional Partnership (DOD)
Nevada Bureau of Mines & Geology
US Geological Survey
Kentucky Geological Survey
Southern Methodist University
Arizona Geological Survey
State Geological Survey Hub
National & Other Geothermal Hub
NGDS is built on the USGIN!
NGDS
National Geothermal Data System

USGIN Node Requirements

Must provide at least one of the following:

1. Hosting a web-accessible folder with USGIN ISO profile metadata, registered for harvesting

2. Hosting a CSW 2.0.2 catalog service with USGIN ISO profile metadata, registered for harvesting

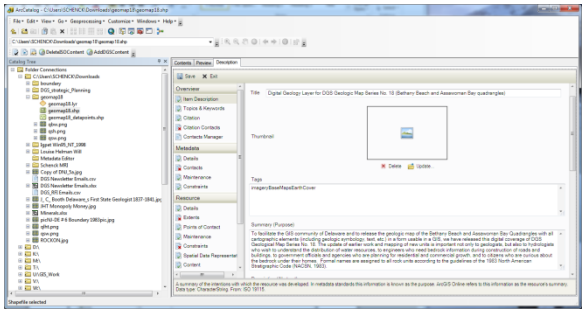
3. Hosting one or more conformant web services (WMS, WFS…) registered in a central catalog

Delaware Node Setup

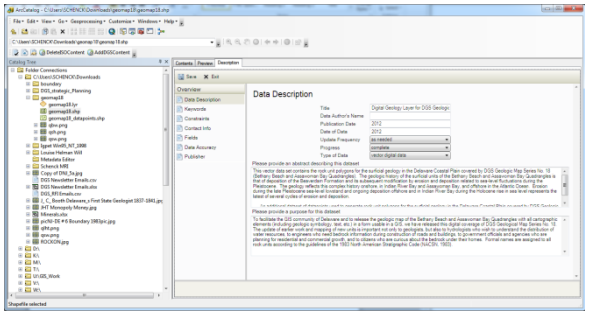
- Postgres/PostGIS – spatially-enabled database
  - Stable, efficient, powerful, vector/raster, etc…
- GeoServer – map server
  - WMS, WFS, WCS, TMS/WMTS, KML, etc…
- GeoNetwork – metadata server
  - CSW 2.0.2, online editing, harvesting capabilities..

All Free and Open Source!

Metadata Publication Process



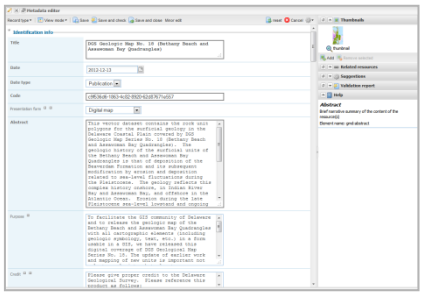
1. ArcGIS Metadata Editor



2. DGS Customized ArcGIS Editor

GEOCAT
GOVERNMENT GEOGRAPHIC DATA PUBLISHING

3. GEOCAT Bridge for ArcGIS



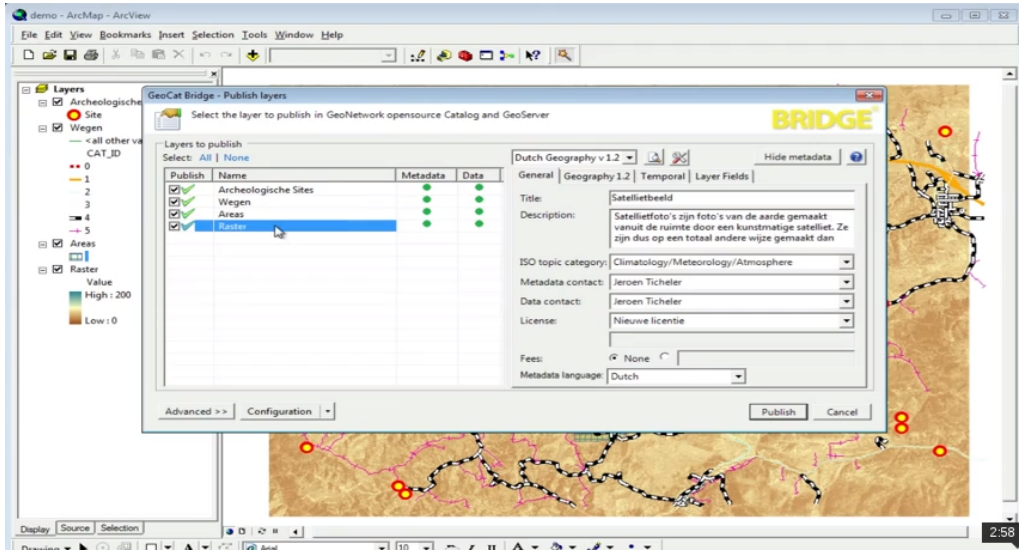
4. GeoNetwork Online Editor

Metadata Publication Process

GEOCAT Bridge Wins!

- Creation of metadata and SLDs
- Direct publication to GeoServer and GeoNetwork

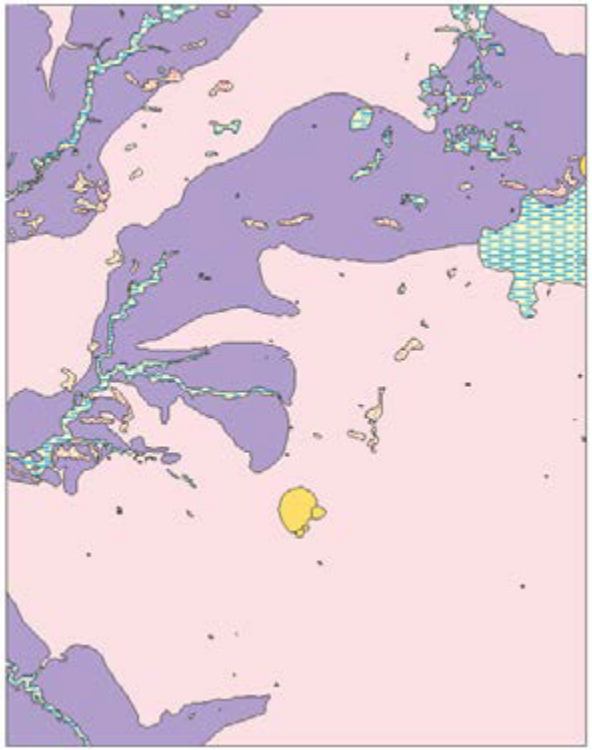
$$$



$$$

Data - Content

- 1:24K and 1:100K surface geologic maps (15 maps)
- All data stored in PostGIS
- SQL Join (View) to attribute table
- Based on GeoSciML-Portrayal

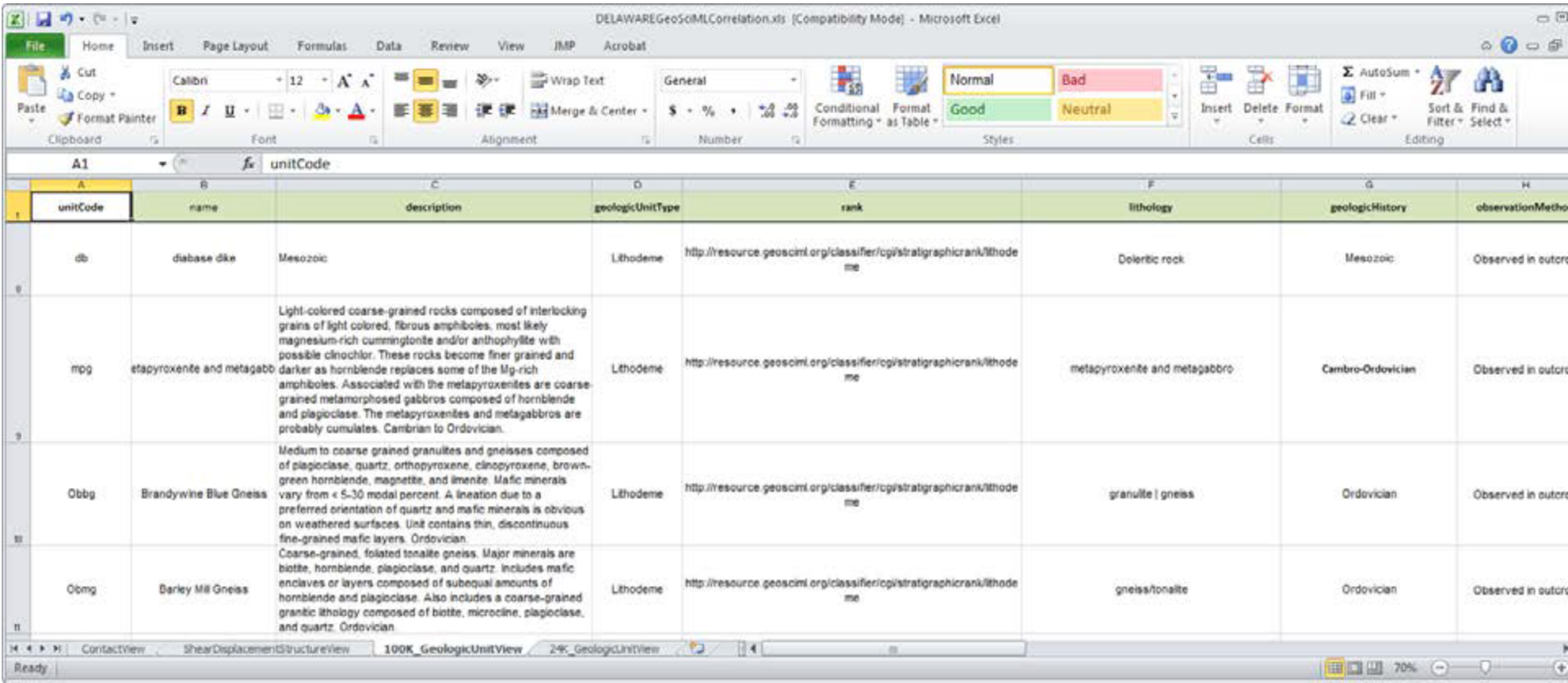


GeoSciML-Portrayal

- An XML markup language for encoding geoscience information.
- GeoSciML-Portrayal is a subset of the Geoscience Markup Language (GML).
- Includes XML request/response language AND *schemas and vocabularies for simple features*
- Designed for interoperability (selected for use in USGIN)

GeoSciML-Portrayal

- Schema: GeologicUnitView, ContactView, or ShearDisplacementView



DELAWAREGeoSciMLCorrelation.xls [Compatibility Mode] - Microsoft Excel

unitCode	name	description	geologicUnitType	rank	lithology	geologicHistory	observationMetho
db	diabase dike	Mesozoic	Lithodeme	http://resource.geosciml.org/classifier/cgi/stratigraphicrank/lithodeme	Doleritic rock	Mesozoic	Observed in outcro
mpg	etapyroxenite and metagabb	Light-colored coarse-grained rocks composed of interlocking grains of light colored, fibrous amphiboles, most likely magnesium-rich cummingtonite and/or anthophyllite with possible clinochlor. These rocks become finer grained and darker as hornblende replaces some of the Mg-rich amphiboles. Associated with the metapyroxenites are coarse grained metamorphosed gabbros composed of hornblende and plagioclase. The metapyroxenites and metagabbros are probably cumulates. Cambrian to Ordovician.	Lithodeme	http://resource.geosciml.org/classifier/cgi/stratigraphicrank/lithodeme	metapyroxenite and metagabbro	Cambro-Ordovician	Observed in outcro
Obbg	Brandywine Blue Gneiss	Medium to coarse grained granulites and gneisses composed of plagioclase, quartz, orthopyroxene, clinopyroxene, brown-green hornblende, magnetite, and ilmenite. Mafic minerals vary from < 5-30 modal percent. A lineation due to a preferred orientation of quartz and mafic minerals is obvious on weathered surfaces. Unit contains thin, discontinuous fine-grained mafic layers. Ordovician.	Lithodeme	http://resource.geosciml.org/classifier/cgi/stratigraphicrank/lithodeme	granulite | gneiss	Ordovician	Observed in outcro
Obmg	Barley Mill Gneiss	Coarse-grained, foliated tonalite gneiss. Major minerals are biotite, hornblende, plagioclase, and quartz. Includes mafic enclaves or layers composed of subequal amounts of hornblende and plagioclase. Also includes a coarse-grained granitic lithology composed of biotite, microcline, plagioclase, and quartz. Ordovician	Lithodeme	http://resource.geosciml.org/classifier/cgi/stratigraphicrank/lithodeme	gneiss/tonalite	Ordovician	Observed in outcro

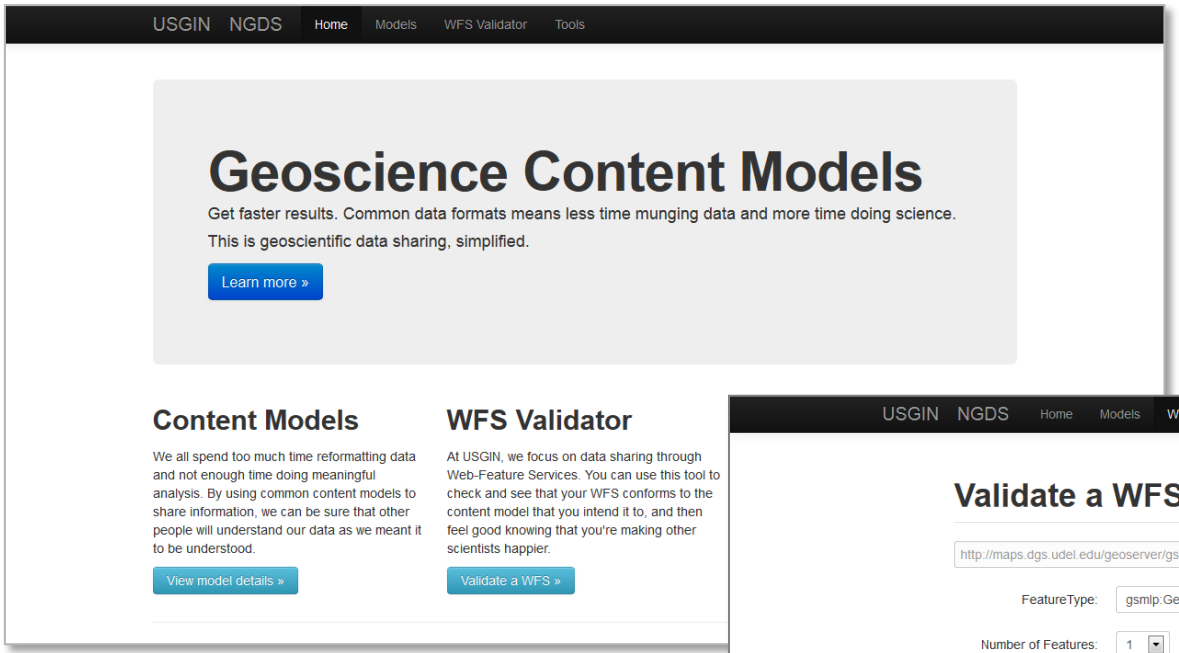
GeoSciML-Portrayal

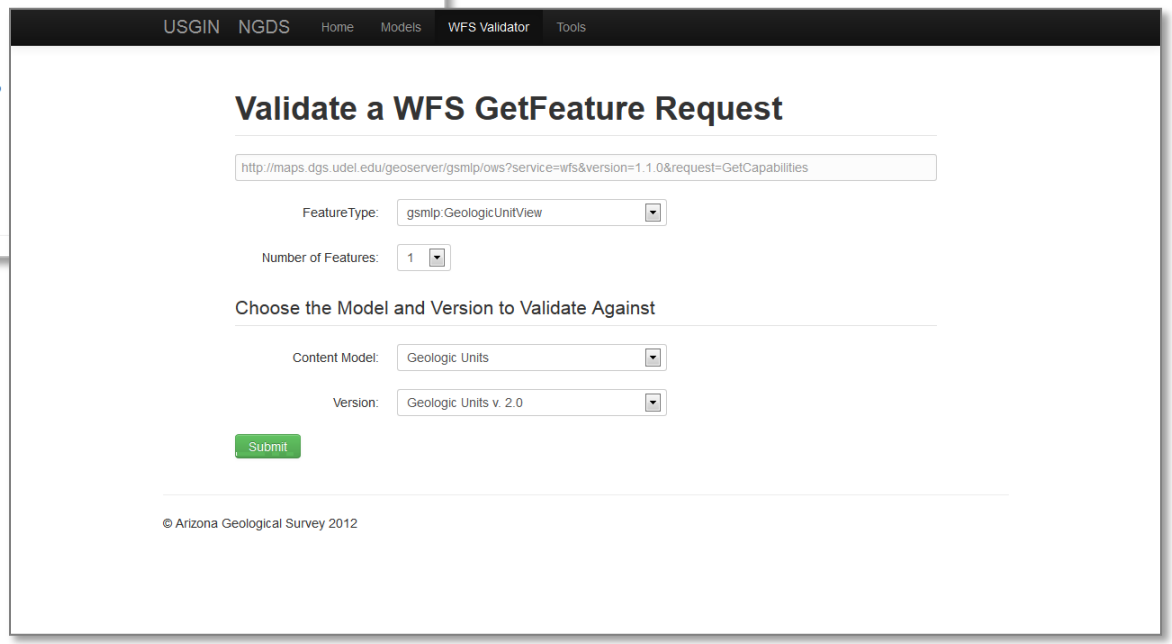
Attribute	Value (e.g.)
formationCode	Obbg
name	Brandywine Blue Gneiss
description	Medium to coarse grained granulites and gneisses composed of plagioclase, quartz, orthopyroxene, clinopyroxene, brown-green hornblende, magnetite, and ilmenite. Mafic minerals vary from < 5-30 modal percent
geologicUnitType	Lithodeme
rank	http://resource.geosciml.org/classifier/cgi/stratigraphicrank/lithodeme
lithology	granulite | gneiss
geologicHistory	Ordovician
observationMethod	Observed in outcrop
positionalAccuracy	In accordance with National Map Accuracy Standards for 1:100,000 scale maps +/- 166 Feet.

GeoSciML-Portrayal

Attribute	Value (e.g.)
source	GM10 Bedrock Geologic Map of The Piedmont of Delaware and the Adjacent Pennsylvania, Schenck, W.S., Plank, M.O., and Srogi, L., 2000.
geologicUnitType_uri	http://resource.geosciml.org/classifier/cgi/geologicunittype/lithodemic_unit
representativeLithology_uri	http://resource.geosciml.org/classifier/cgi/lithology/granulite
representativeAge_uri	http://resource.geosciml.org/classifier/ics/ischart/Ordovician
representativeOlderAge_uri	http://resource.geosciml.org/classifier/ics/ischart/Ordovician
representativeYoungerAge_uri	http://resource.geosciml.org/classifier/ics/ischart/Ordovician
specification_uri	http://www.dgs.udel.edu/delaware-geology/unit/brandywine-blue-gneiss
metadata_uri	http://maps.dgs.udel.edu/geonetwork/apps/search/?uuid=342a92b9-a7fe-4a2a-a8c2-aa60871636e6
genericSymbolizer	1.1.3

GeoSciML-Portrayal

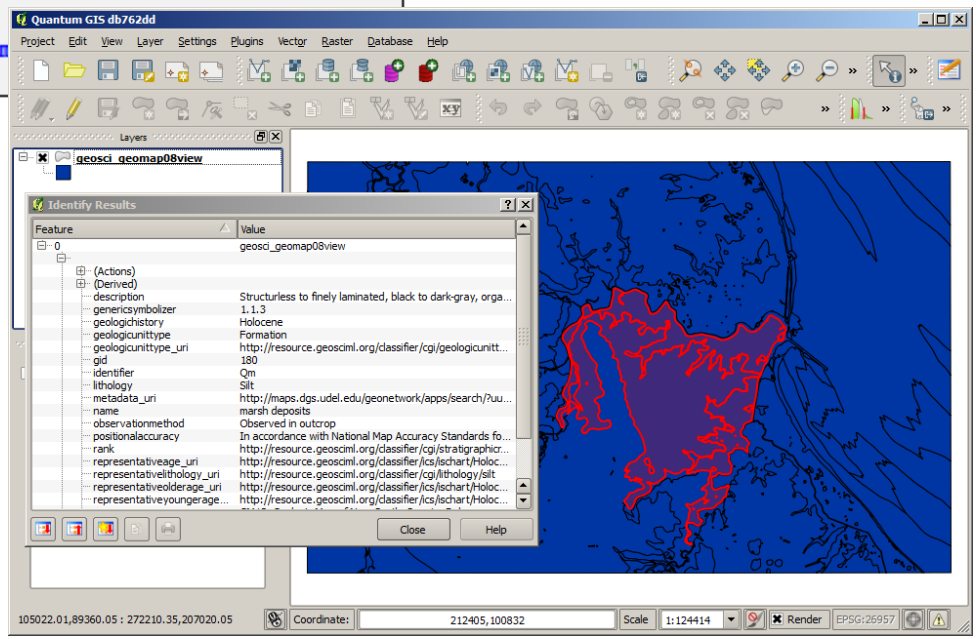




GeoSciML-Portrayal

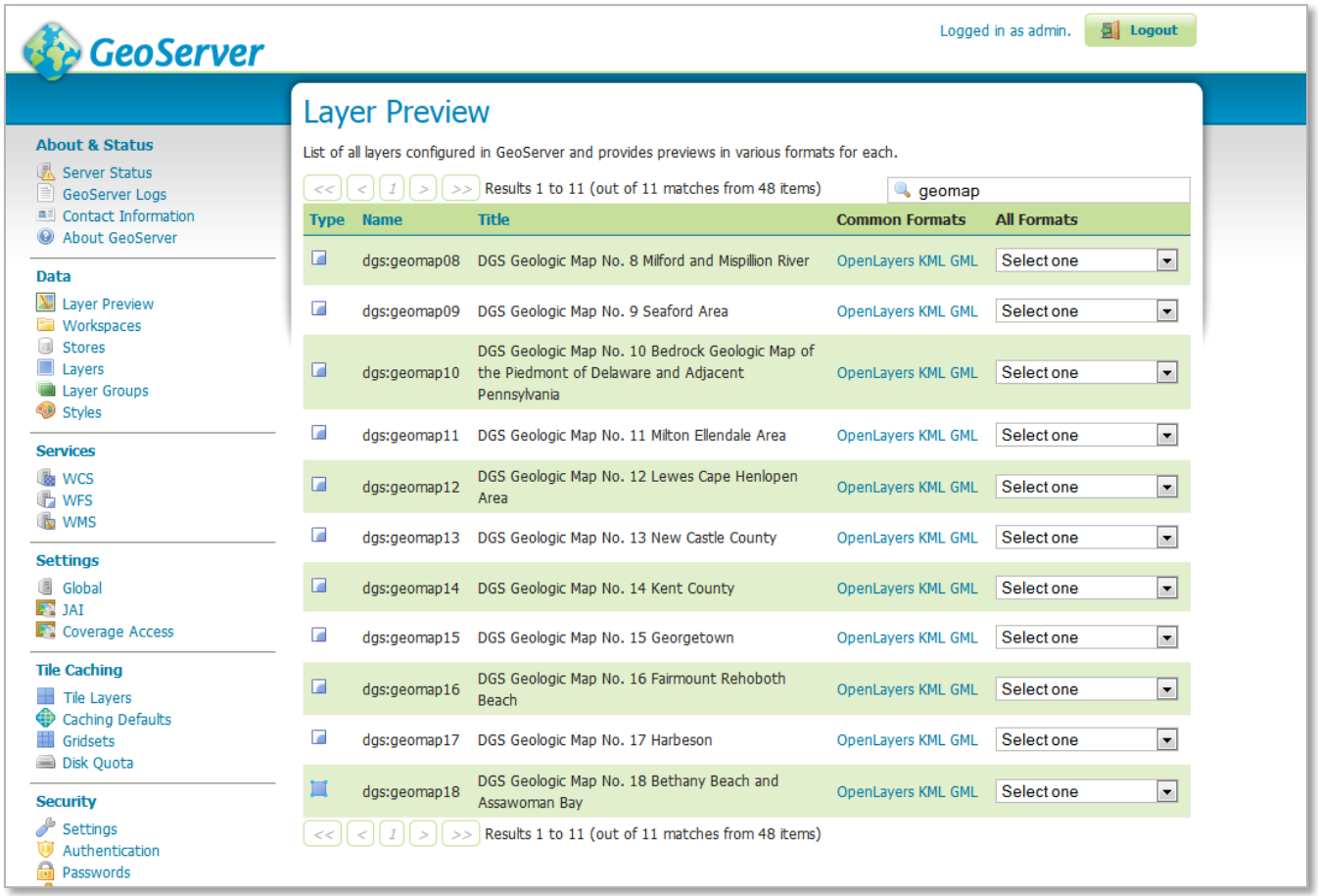
```
CREATE OR REPLACE VIEW public.geosci_geomap18view AS
 SELECT geo.gid, geo.geo_unit_s AS identifier, tab.name, tab.description,
tab."geologicUnitType", tab.rank, tab.lithology, tab."geologicHistory",
tab."observationMethod", tab."positionalAccuracy", tab.source,
tab."geologicUnitType_uri", tab."representativeLithology_uri",
tab."representativeAge_uri", tab."representativeOlderAge_uri",
tab."representativeYoungerAge_uri", tab.specification_uri, tab.metadata_uri,
tab."genericSymbolizer", geo.geom
   FROM geomap18 geo
   LEFT JOIN geosci_geolunits24k tab ON geo.geo_unit_s::text =
tab.formationcode::text;

ALTER TABLE geosci_geomap18view OWNER TO mydbaname;
GRANT SELECT ON TABLE geosci_geomap18view TO mypubnam
```



Open Web Mapping Services

- WMS, WFS, WCS, KML



OneGeology

- Launched in 2007, OneGeology is an initiative of international geological surveys to create a current, dynamic and seamless geological map of the world.

- DGS published 1:100K geologic units and contacts for Delaware

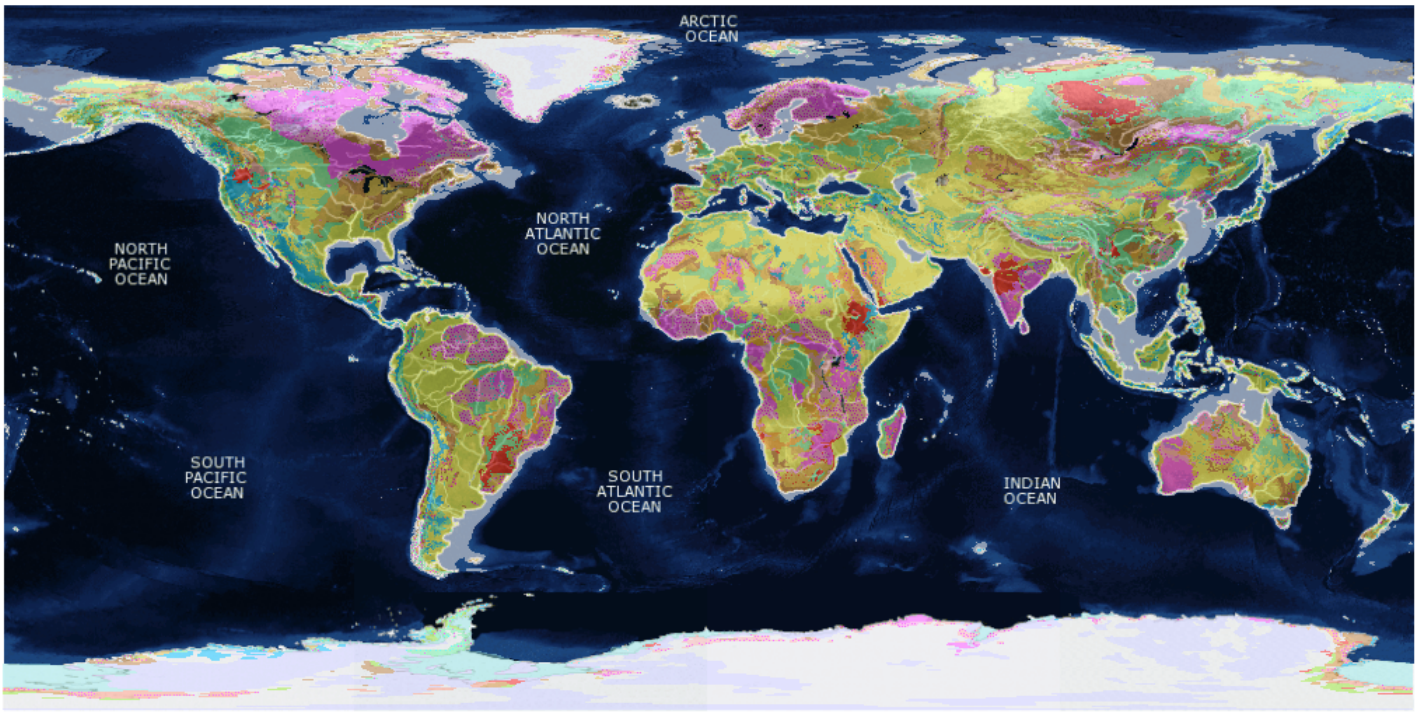
"Making Geological Map Data for the Earth Accessible"

Catalogues | Vocabularies | Help | About

Automatically display layers depending on scale and location

Providing geoscience data globally

OneGeology Portal

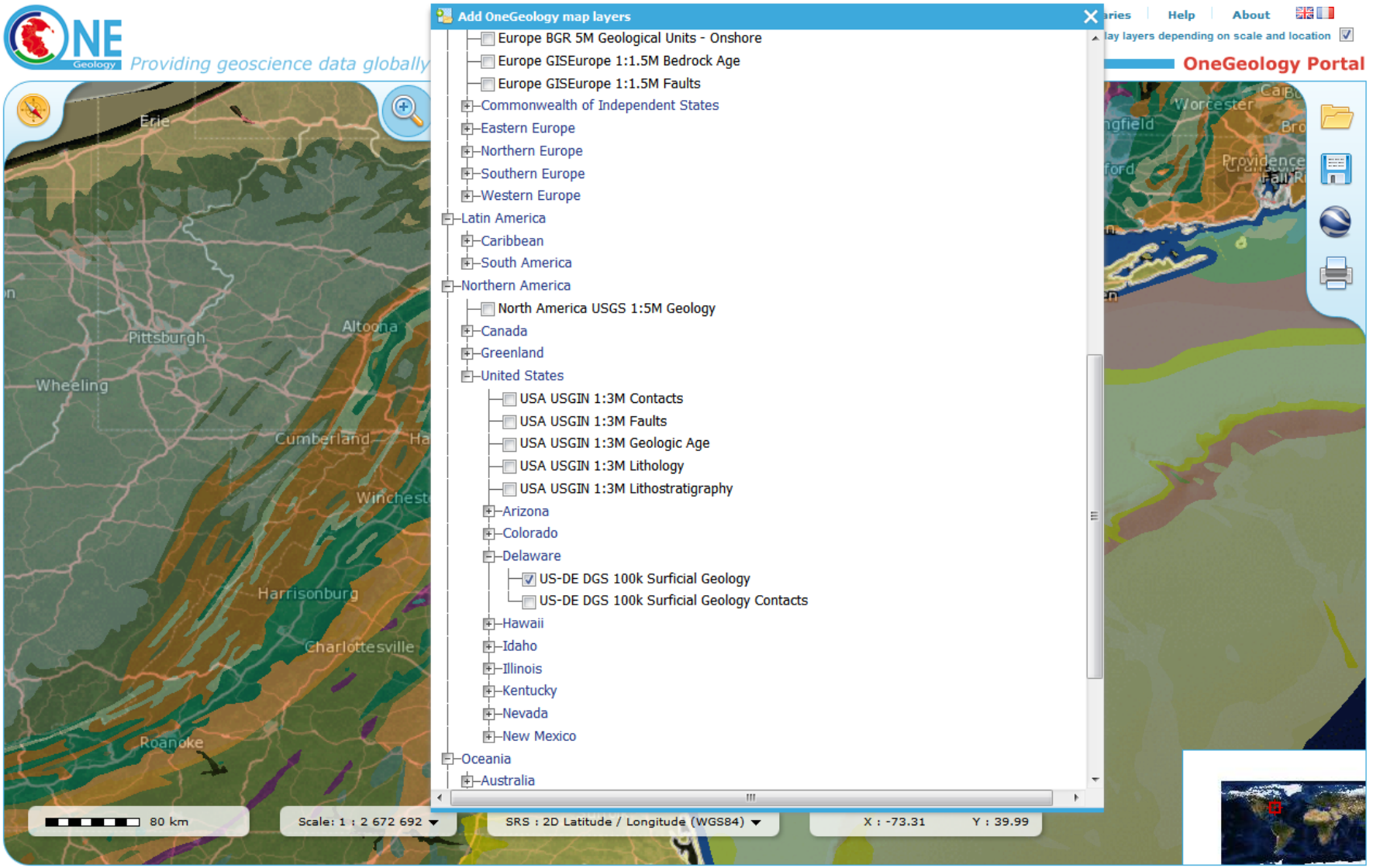


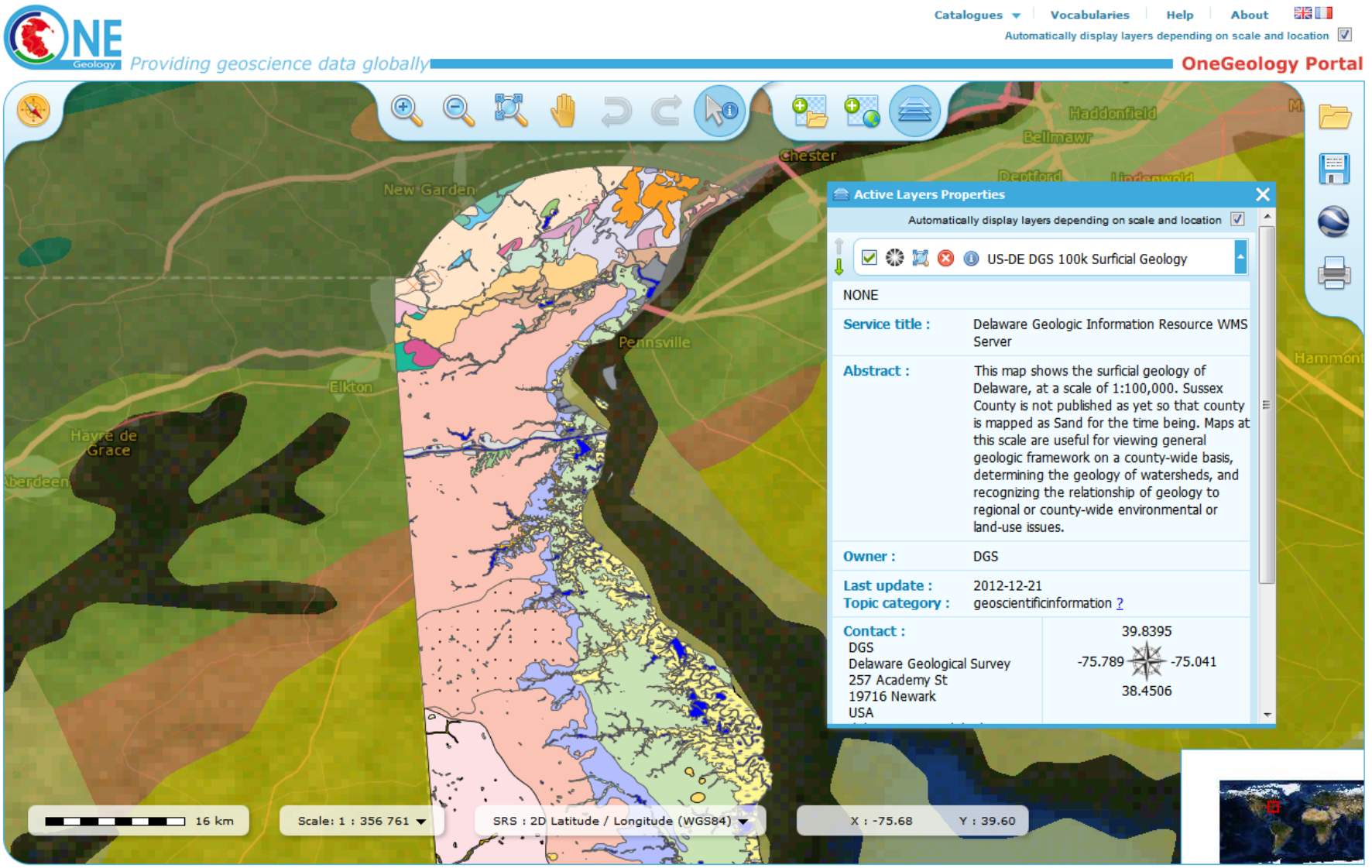
4000 km

Scale: 1 : 112 500 000

SRS : 2D Latitude / Longitude (WGS84)

X : 157.87 Y : 115.54


Providing geoscience data globally
Help
About
OneGeology Portal
Add OneGeology map layers
Europe BGR 5M Geological Units - Onshore
Europe GISEurope 1:1.5M Bedrock Age
Europe GISEurope 1:1.5M Faults
Commonwealth of Independent States
Eastern Europe
Northern Europe
Southern Europe
Western Europe
Latin America
Caribbean
South America
Northern America
North America USGS 1:5M Geology
Canada
Greenland
United States
USA USGIN 1:3M Contacts
USA USGIN 1:3M Faults
USA USGIN 1:3M Geologic Age
USA USGIN 1:3M Lithology
USA USGIN 1:3M Lithostratigraphy
Arizona
Colorado
Delaware
US-DE DGS 100k Surficial Geology
US-DE DGS 100k Surficial Geology Contacts
Hawaii
Idaho
Illinois
Kentucky
Nevada
New Mexico
Oceania
Australia
Erie
Pittsburgh
Altoona
Wheeling
Cumberland
Harrisonburg
Charlottesville
Roanoke
Worcester
Providence
80 km
Scale: 1 : 2 672 692
SRS : 2D Latitude / Longitude (WGS84)
X : -73.31
Y : 39.99


Catalogues
Vocabularies
Help
About
Automatically display layers depending on scale and location
Providing geoscience data globally
OneGeology Portal
Active Layers Properties
Automatically display layers depending on scale and location
US-DE DGS 100k Surficial Geology
NONE
Service title :
Delaware Geologic Information Resource WMS Server
Abstract :
This map shows the surficial geology of Delaware, at a scale of 1:100,000. Sussex County is not published as yet so that county is mapped as Sand for the time being. Maps at this scale are useful for viewing general geologic framework on a county-wide basis, determining the geology of watersheds, and recognizing the relationship of geology to regional or county-wide environmental or land-use issues.
Owner :
DGS
Last update :
2012-12-21
Topic category :
geoscientificinformation ?
Contact :
DGS
Delaware Geological Survey
257 Academy St
19716 Newark
USA
39.8395
-75.789
-75.041
38.4506
Chester
New Garden
Pennsville
Elkton
Havre de Grace
Haddonfield
Bellmawr
Deptford
16 km
Scale: 1 : 356 761
SRS : 2D Latitude / Longitude (WGS84)
X : -75.68
Y : 39.60

OneGeology Accreditation

Rating	Service	Notes
One Star ⭐	Basic WMS	GetMap, GetCapabilities
Two Stars ⭐⭐	Upgraded WMS	+ map legend, keywords, +
Three Stars ⭐⭐⭐	Enhanced WMS	+ GetFeeatureInfo, WMS 1.3.0, ISO19115, +
Four Stars ⭐⭐⭐⭐	Web Feature Service	+ WFS 1.1.0, ISO Metadata, GeoSciML-Portrayal +
Five Stars ⭐⭐⭐⭐⭐	Enhanced WFS	+ GeoSciML v3

Now what?

- Published ISO Metadata 
- Open Mapping Services 
- GeoSciML-Portrayal 
- USGIN node 

Now what?

- Published ISO Metadata 
- Open Mapping Services 
- GeoSciML-Portrayal 
- USGIN node 
- What about other DGS data??????

Delaware Geologic Information Resource (DGIR)

The Delaware Geologic Information Resource (DGIR) is an online system for discovery, distribution, and visualization of geologic and hydrologic information released by the Delaware Geological Survey. DGIR is composed of three components: the DGIR MapViewer (an online map viewer with GIS-like functionailty), the DGIR Metadata Catalog (a search and discovery interface for metadata of published DGS datasets and map services), and DGIR Services (a set of OGC-compliant WMS, WFS, and WCS map service.)

DGIR MapViewer

The DGIR MapViewer is an data display tool and map client for a variety of geologic, hydrologic and basemap information for Delaware. Currently, more then 40 layers are included in the map viewer, each one powered by WMS and WFS map services.

DGIR Map Viewer showing DGS GeoMap 10.

The map viewer includes basic GIS functions, such as pan/zoom, identify, etc..., on Google Maps. Users can access underlying data through via point-and-click in three tools: Well Query Tool, Surface Query Tool, and the Subsurface Query Tool.

Launch the DGIR MapViewer

DGIR Metadata Catalog

The DGIR Catalog is a metadata repository for DGS published datasets and services and is part of the US Geoscience Information Network (USGIN). It supports harvesting and Catalog Service for the Web (CSW) and OAI-PMH search protocols. Metadata records comply with the ISO 19139 standard.


DGIR Catalog search results page

The web interface allows for both spatial and textual search, such as through full-text searches or via keywords or categories. Data can be downloaded as zip files or displayed (as WMS map services) directly in the embedded viewer.

Browse the DGIR Metadata CataLog

DGIR Web Services

The back end of DGIR is powered by Open Geospatial Consortium (OGC)-compliant web mapping services, designed or interoperability. All of the geologic and hydrologic maps published in the DGIR Map Viewer and DGIR Catalog are served as Web Map Service (WMS) as well as either Web Feature Service (WFS) or Web Coverage Service (WCS) map services as appropriate.

CERTIFIED OGC® COMPLIANT
WCS 1.0
WMS 1.1.1
WFS 1.0

The services can be viewed through the DGIR Map Viewer as well as accessed directly through a GIS desktop (ArcGIS, QGIS) or your own custom applications. Services support GetFeatureInfo (i.e, Identify) requests and custom Style Layer Descriptor (SLD) files.

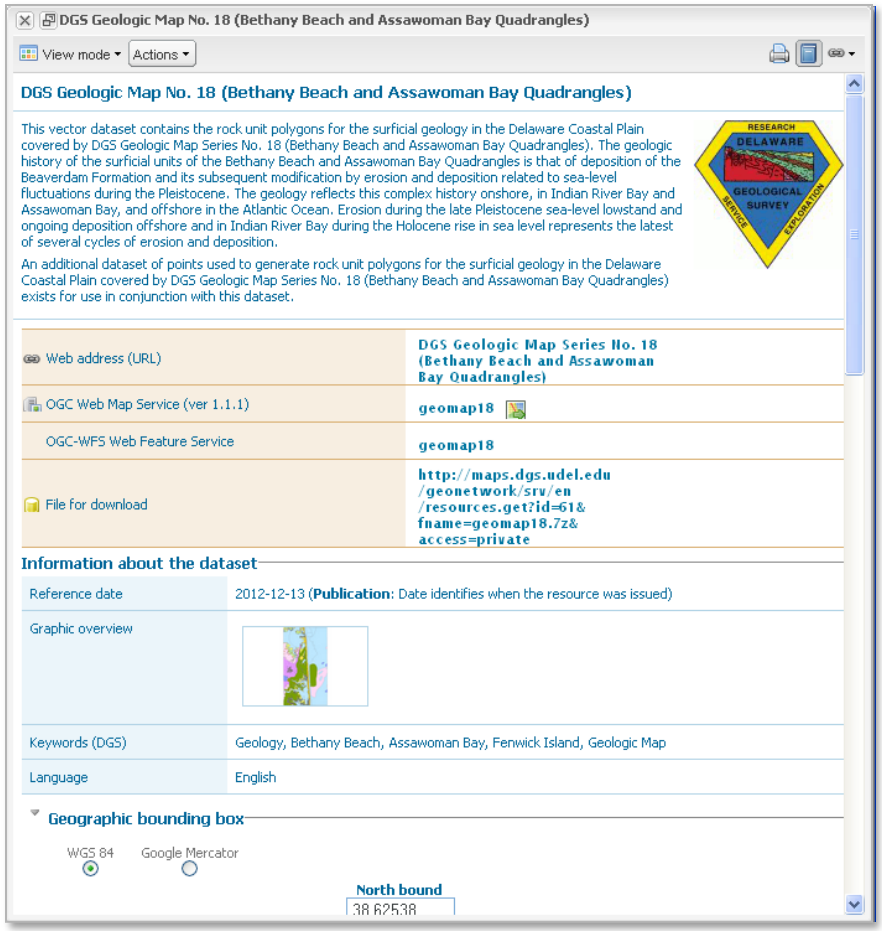
Sservices of Delaware statewide surficial geologic maps are also published to the OneGeology initiative.

View DGIR Services

Phone: 302-831-2833 | Fax: 302-831-3579 | Email: delgeosurvey@udel.edu

DGIR Metadata Catalog

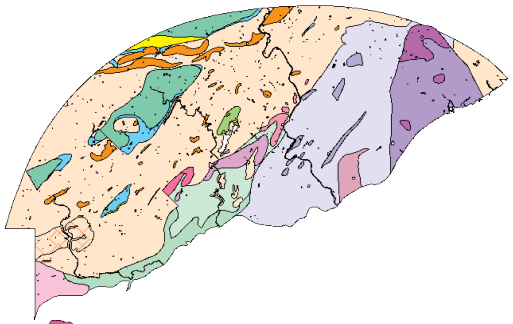
- Description of your data/ map/service
  - Title, date, scale, constraints, spatial reference, access…
- References a data set or web service.
- Standardized: easy to read, catalog, and index.
- Harvested by USGIN

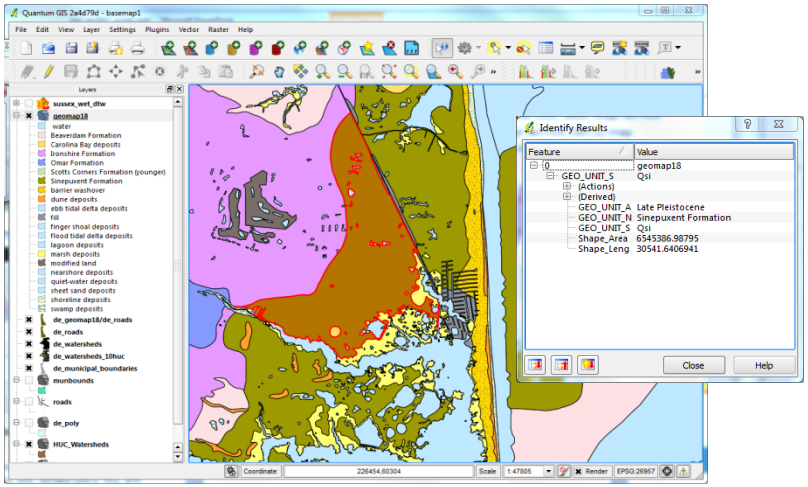


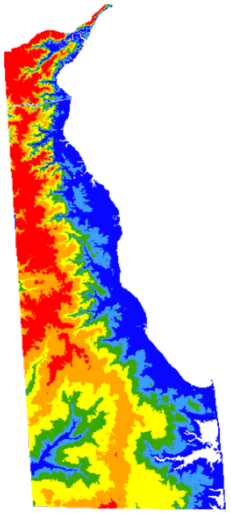
DGIR Web Services

- Data, tables or maps, through the web (analogous to streaming video)
- Web Map Service (WMS)
- Web Feature Service (WFS)
- Web Coverage Service (WCS)

Open Protocols!





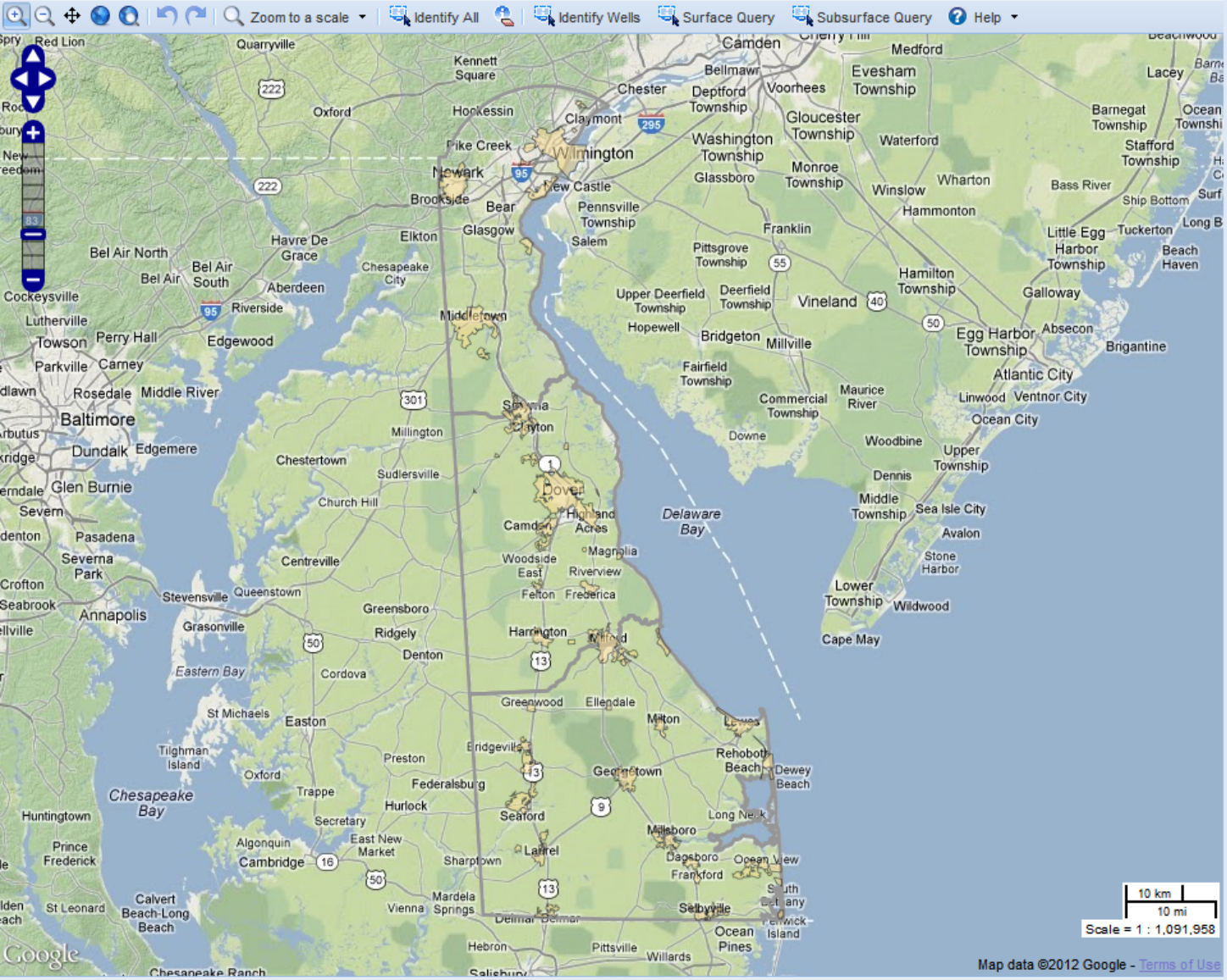


DGIR Map Viewer

- Map-based (point and click) interface to geologic and hydrogeologic resources
- USGIN data (units and contacts)
- Basemap
  - roads, waterways, boundaries, DEM, etc…
- Other DGS Data
  - Wells, recharge areas, depth to water table, depth to aquifers (coming soon), geophysical logs, descriptive logs

DGIR

DGS Digital Geologic Information Respository



Available data layers

Select / search data layers

- Base Map Data
- Groundwater – Point Observations
  - Groundwater Observations and Hydrographs
  - Groundwater Observations
  - Sites with Lithologic Logs
  - Sites with Downhole Geophysical Logs
- Groundwater - Area and Gridded Data
- Surficial Geologic Maps
- Reference
- Cross-Section (Published) Locations

Active data layers

Check all | Uncheck all | Remove all

- Municipal Boundaries
- Delaware Boundary

Active data legends

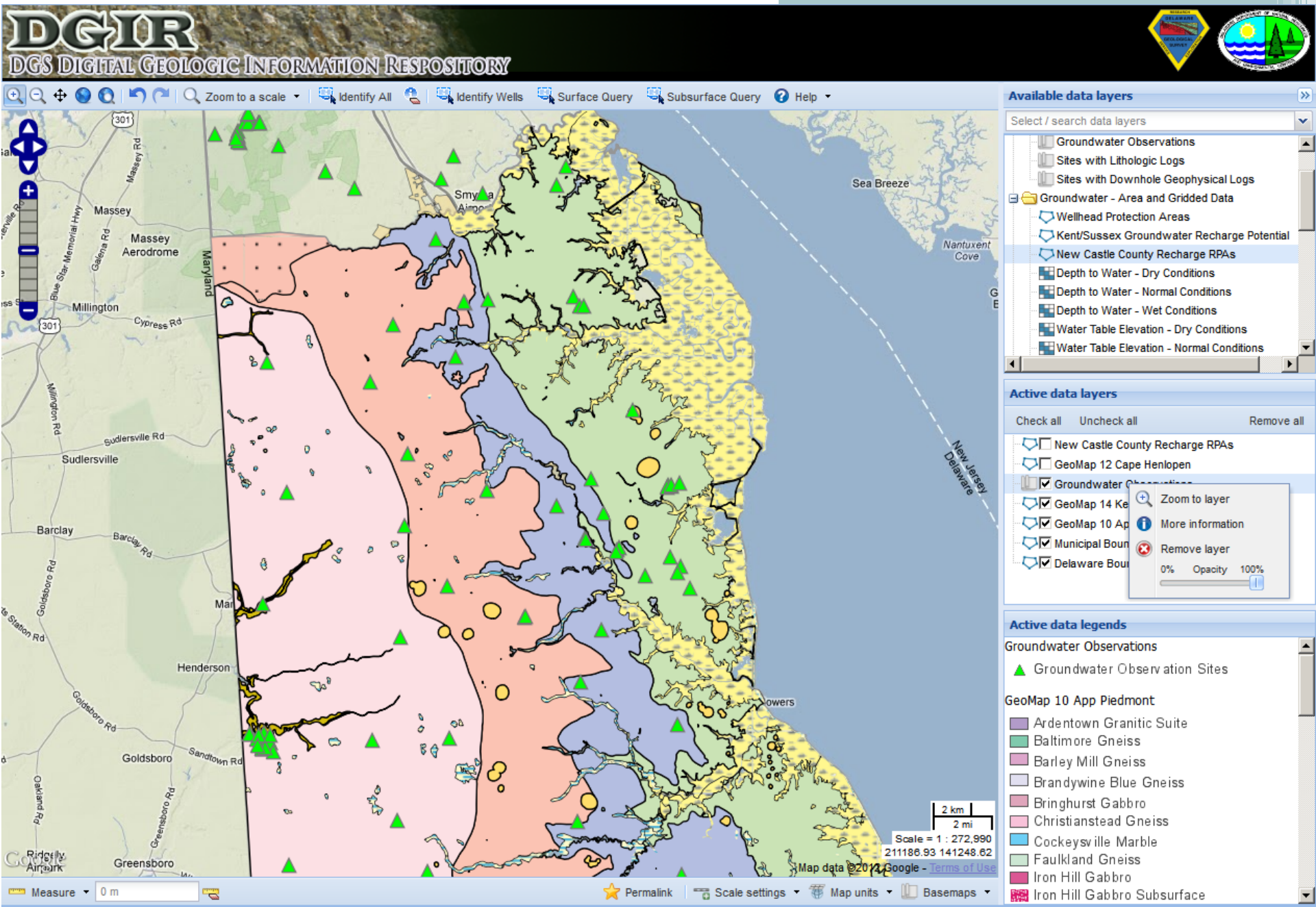
Municipal Boundaries

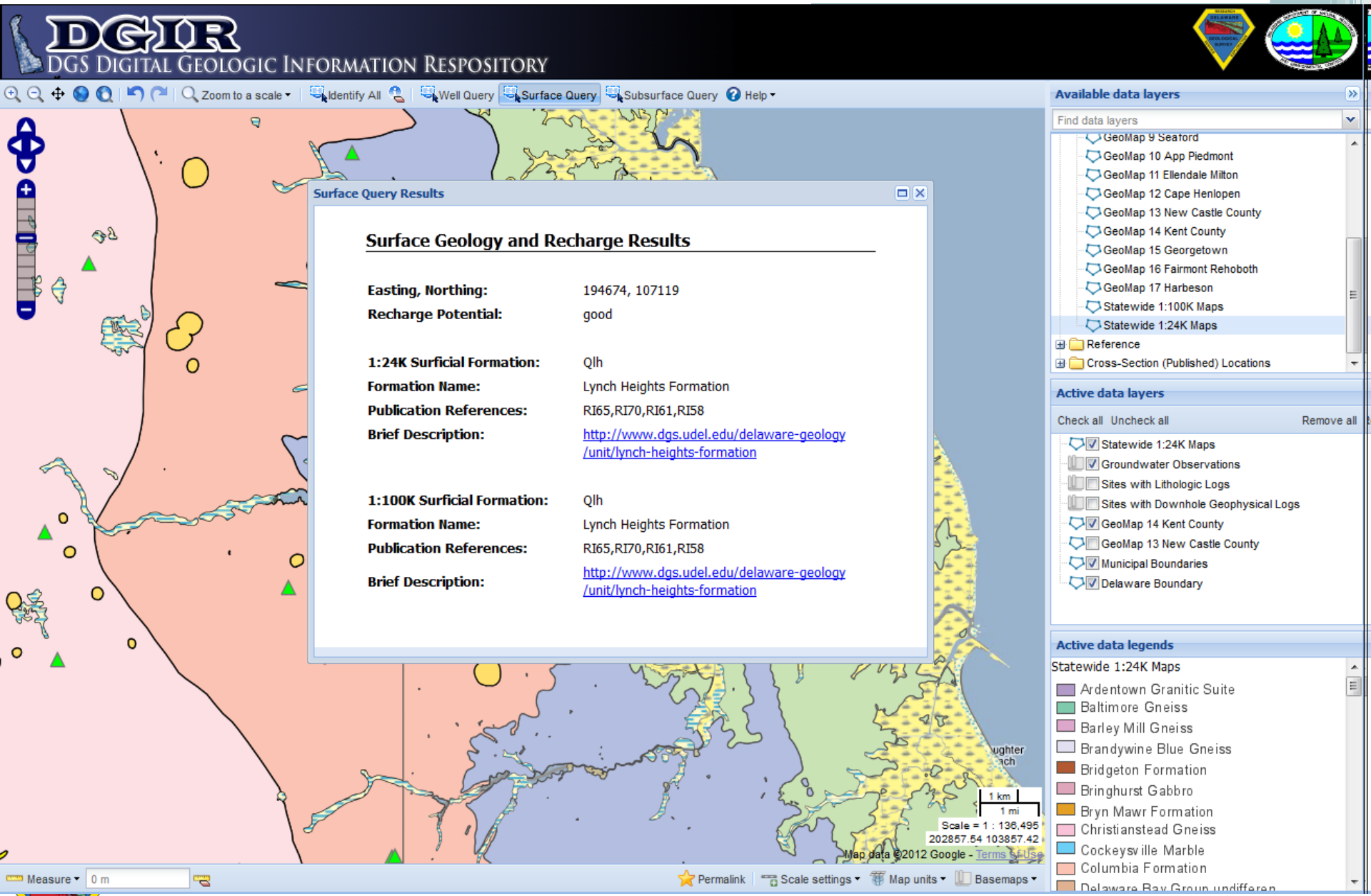
Municipal Boundaries

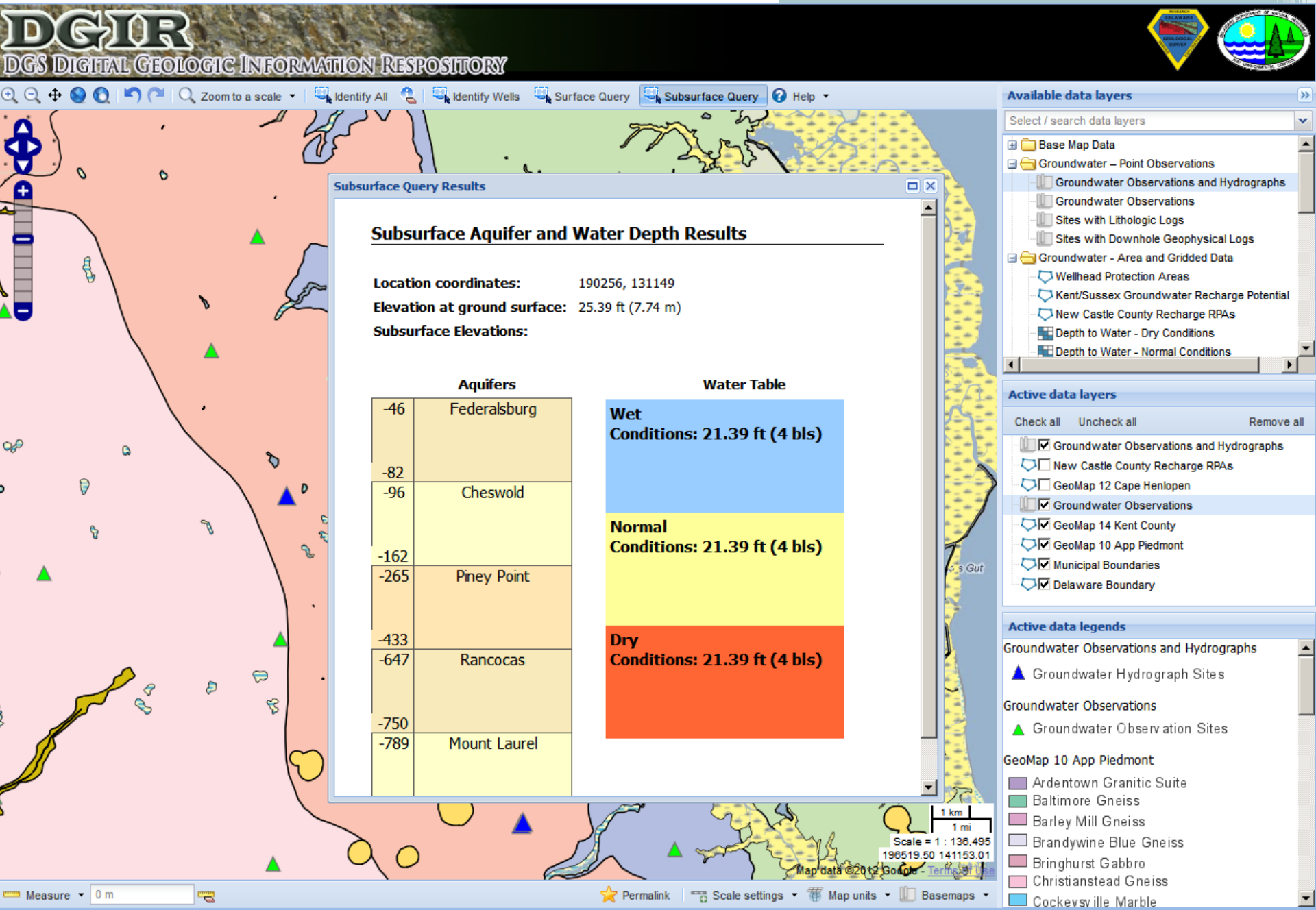
Delaware Boundary

State Boundary Lines

Measure | 0 m | Permalink | Scale settings | Map units | Basemaps


DGIR
DGS Digital Geologic Information Respository
Zoom to a scale
Identify All
Identify Wells
Surface Query
Subsurface Query
Help
Available data layers
Select / search data layers
Groundwater Observations
Sites with Lithologic Logs
Sites with Downhole Geophysical Logs
Groundwater - Area and Gridded Data
Wellhead Protection Areas
Kent/Sussex Groundwater Recharge Potential
New Castle County Recharge RPAs
Depth to Water - Dry Conditions
Depth to Water - Normal Conditions
Depth to Water - Wet Conditions
Water Table Elevation - Dry Conditions
Water Table Elevation - Normal Conditions
Active data layers
Check all
Uncheck all
Remove all
New Castle County Recharge RPAs
GeoMap 12 Cape Henlopen
Zoom to layer
More information
Remove layer
0%
Opacity
100%
Active data legends
Groundwater Observations
Groundwater Observation Sites
GeoMap 10 App Piedmont
Ardentown Granitic Suite
Baltimore Gneiss
Barley Mill Gneiss
Brandywine Blue Gneiss
Bringhurst Gabbro
Christianstead Gneiss
Cockeysville Marble
Faulkland Gneiss
Iron Hill Gabbro
Iron Hill Gabbro Subsurface
Massey
Massey Aerodrome
Millington
Sudlersville
Barclay
Henderson
Goldsboro
Greensboro
Sea Breeze
Nantuxent Cove
Smyrna
Maryland
New Jersey
Delaware
Scale = 1 : 272,990
211186.93 141248.62
Map data ©2012 Google - Terms of Use
Measure
Permalink
Scale settings
Map units
Basemaps


DGIR
DGS Digital Geologic Information Respository
Zoom to a scale
Identify All
Well Query
Surface Query
Subsurface Query
Help
Surface Query Results
Surface Geology and Recharge Results
Easting, Northing: 194674, 107119
Recharge Potential: good
1:24K Surficial Formation: Qlh
Formation Name: Lynch Heights Formation
Publication References: RI65,RI70,RI61,RI58
Brief Description: http://www.dgs.udel.edu/delaware-geology/unit/lynch-heights-formation
1:100K Surficial Formation: Qlh
Formation Name: Lynch Heights Formation
Publication References: RI65,RI70,RI61,RI58
Brief Description: http://www.dgs.udel.edu/delaware-geology/unit/lynch-heights-formation
Available data layers
Find data layers
GeoMap 9 Seaford
GeoMap 10 App Piedmont
GeoMap 11 Ellendale Milton
GeoMap 12 Cape Henlopen
GeoMap 13 New Castle County
GeoMap 14 Kent County
GeoMap 15 Georgetown
GeoMap 16 Fairmont Rehoboth
GeoMap 17 Harbeson
Statewide 1:100K Maps
Statewide 1:24K Maps
Reference
Cross-Section (Published) Locations
Active data layers
Check all Uncheck all Remove all
Statewide 1:24K Maps
Groundwater Observations
Sites with Lithologic Logs
Sites with Downhole Geophysical Logs
GeoMap 14 Kent County
GeoMap 13 New Castle County
Municipal Boundaries
Delaware Boundary
Active data legends
Statewide 1:24K Maps
Ardentown Granitic Suite
Baltimore Gneiss
Barley Mill Gneiss
Brandywine Blue Gneiss
Bridgeton Formation
Bringhurst Gabbro
Bryn Mawr Formation
Christianstead Gneiss
Cockeysville Marble
Columbia Formation
1 km
1 mi
Scale = 1 : 136,495
202857.54 103857.42
Map data ©2012 Google - Terms of Use
Measure
0 m
Permalink
Scale settings
Map units
Basemaps


DGIR
DGS Digital Geologic Information Respository
Zoom to a scale
Identify All
Identify Wells
Surface Query
Subsurface Query
Help
Subsurface Query Results
Subsurface Aquifer and Water Depth Results
Location coordinates: 190256, 131149
Elevation at ground surface: 25.39 ft (7.74 m)
Subsurface Elevations:
Aquifers
Water Table
-46
-82
Federalsburg
-96
-162
Cheswold
-265
-433
Piney Point
-647
-750
Rancocas
-789
Mount Laurel
Wet
Conditions: 21.39 ft (4 bls)
Normal
Conditions: 21.39 ft (4 bls)
Dry
Conditions: 21.39 ft (4 bls)
Available data layers
Select / search data layers
Base Map Data
Groundwater – Point Observations
Groundwater Observations and Hydrographs
Groundwater Observations
Sites with Lithologic Logs
Sites with Downhole Geophysical Logs
Groundwater - Area and Gridded Data
Wellhead Protection Areas
Kent/Sussex Groundwater Recharge Potential
New Castle County Recharge RPAs
Depth to Water - Dry Conditions
Depth to Water - Normal Conditions
Active data layers
Check all
Uncheck all
Remove all
Groundwater Observations and Hydrographs
New Castle County Recharge RPAs
GeoMap 12 Cape Henlopen
Groundwater Observations
GeoMap 14 Kent County
GeoMap 10 App Piedmont
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Delaware Boundary
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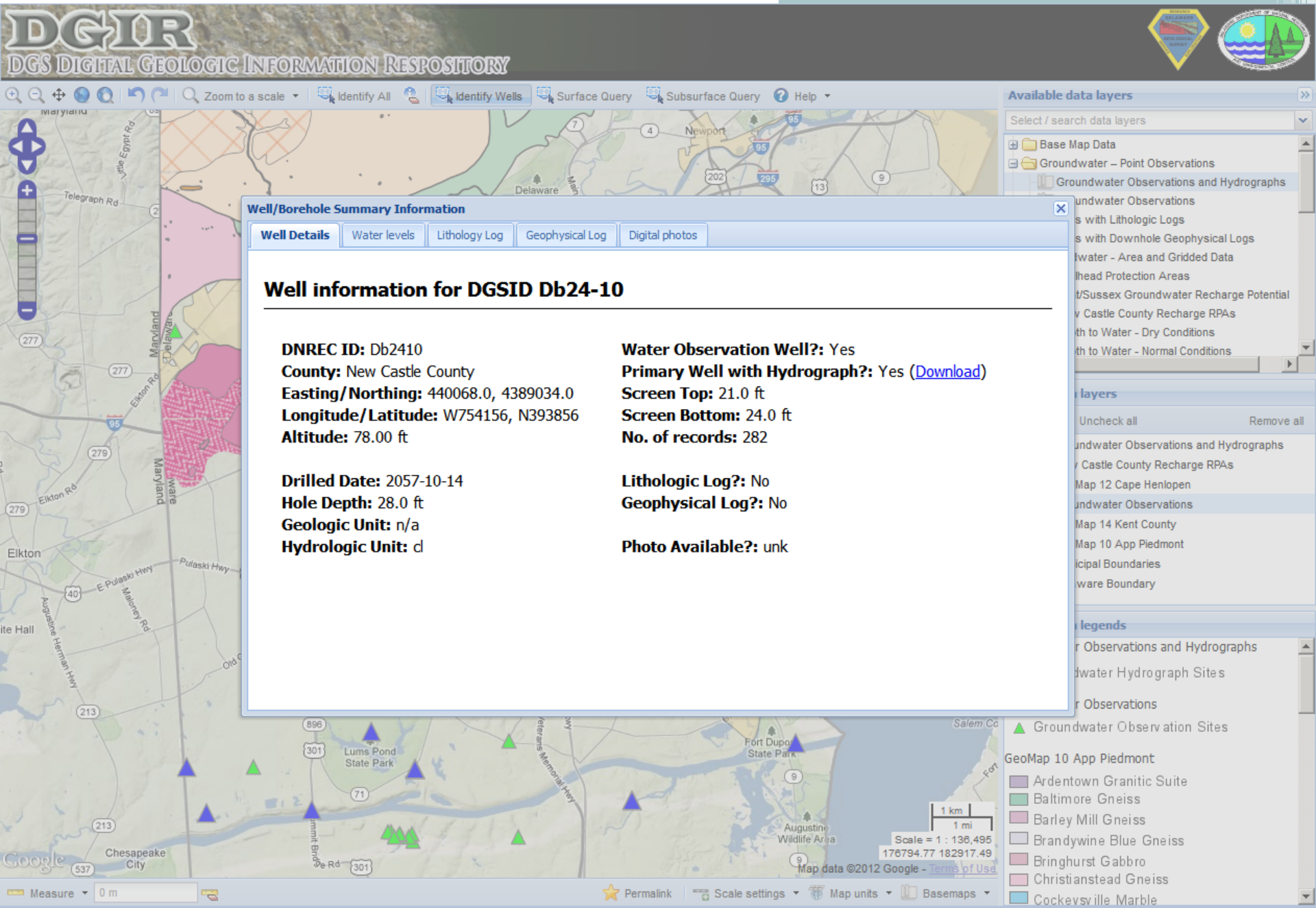
Groundwater Observations and Hydrographs
Groundwater Hydrograph Sites
Groundwater Observations
Groundwater Observation Sites
GeoMap 10 App Piedmont
Ardentown Granitic Suite
Baltimore Gneiss
Barley Mill Gneiss
Brandywine Blue Gneiss
Bringhurst Gabbro
Christianstead Gneiss
Cockeysville Marble
1 km
1 mi
Scale = 1 : 136,495
196519.50 141153.01
Map data ©2012 Google
Measure
0 m
Permalink
Scale settings
Map units
Basemaps


DGIR
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Subsurface Query
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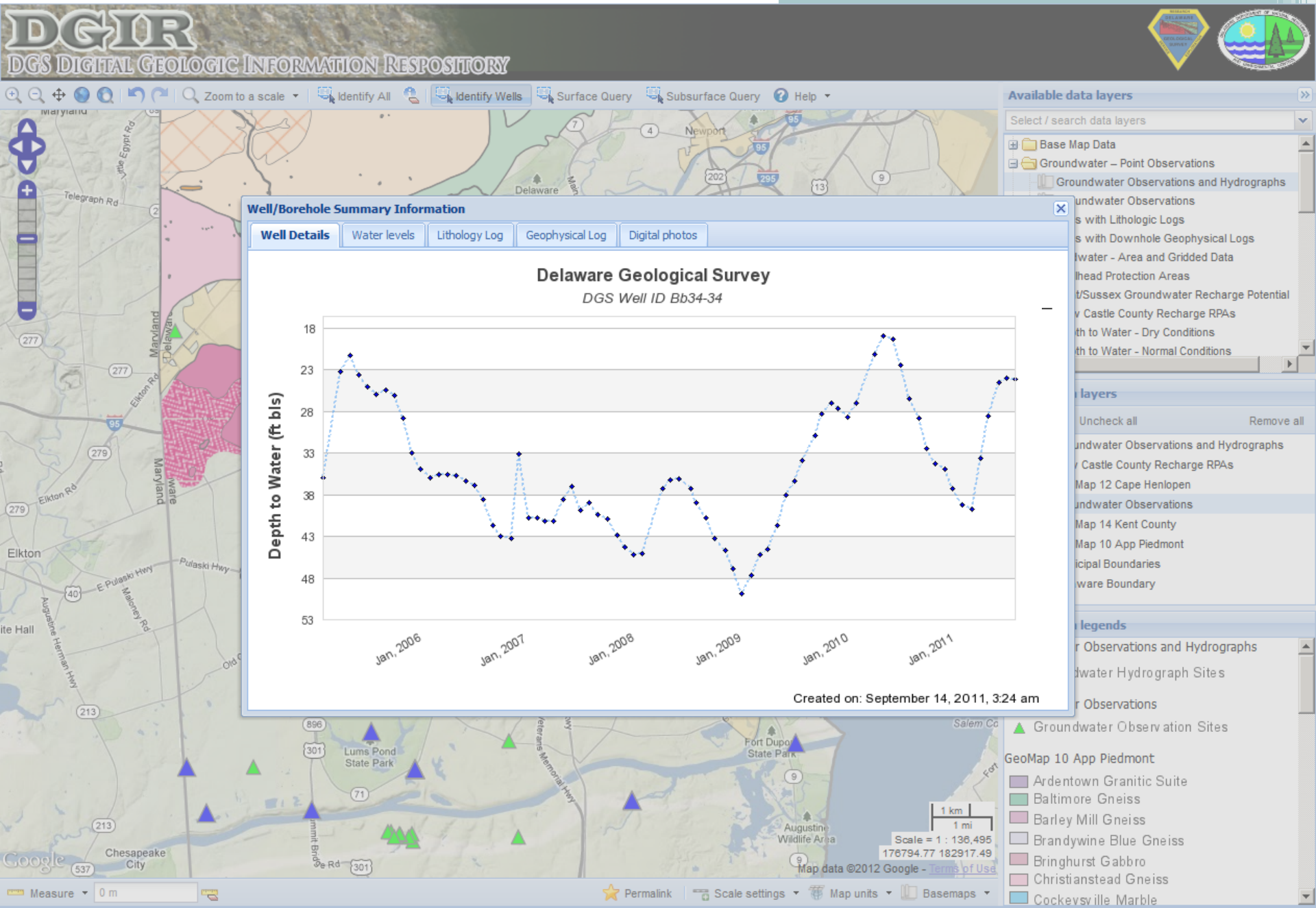
Base Map Data
Groundwater – Point Observations
Groundwater Observations and Hydrographs
Well/Borehole Summary Information
Well Details
Water levels
Lithology Log
Geophysical Log
Digital photos
Well information for DGSID Db24-10
DNREC ID: Db2410
County: New Castle County
Easting/Northing: 440068.0, 4389034.0
Longitude/Latitude: W754156, N393856
Altitude: 78.00 ft
Drilled Date: 2057-10-14
Hole Depth: 28.0 ft
Geologic Unit: n/a
Hydrologic Unit: cl
Water Observation Well?: Yes
Primary Well with Hydrograph?: Yes (Download)
Screen Top: 21.0 ft
Screen Bottom: 24.0 ft
No. of records: 282
Lithologic Log?: No
Geophysical Log?: No
Photo Available?: unk
Uncheck all
Remove all
Groundwater Observation Sites
GeoMap 10 App Piedmont
Ardentown Granitic Suite
Baltimore Gneiss
Barley Mill Gneiss
Brandywine Blue Gneiss
Bringhurst Gabbro
Christianstead Gneiss
Cockeysville Marble
Measure
Permalink
Scale settings
Map units
Basemaps
Map data ©2012 Google


DGIR
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Zoom to a scale
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Subsurface Query
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Available data layers
Select / search data layers
Base Map Data
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Groundwater Observations and Hydrographs
Well/Borehole Summary Information
Well Details
Water levels
Lithology Log
Geophysical Log
Digital photos
Delaware Geological Survey
DGS Well ID Bb34-34
Depth to Water (ft bls)
18
23
28
33
38
43
48
53
Jan, 2006
Jan, 2007
Jan, 2008
Jan, 2009
Jan, 2010
Jan, 2011
Created on: September 14, 2011, 3:24 am
Uncheck all
Remove all
Groundwater Observation Sites
GeoMap 10 App Piedmont
Ardentown Granitic Suite
Baltimore Gneiss
Barley Mill Gneiss
Brandywine Blue Gneiss
Bringhurst Gabbro
Christianstead Gneiss
Cockeysville Marble
Scale = 1 : 136,495
Map data ©2012 Google
Measure
Permalink
Scale settings
Map units
Basemaps

DGIR

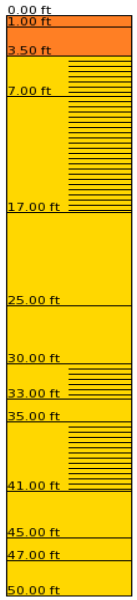
DGS Digital Geologic Information Respository

Zoom to a scale | Identify All | Identify Wells | Surface Query | Subsurface Query | Help

Well/Borehole Summary Information

Well Details | Water levels | Lithology Log | Geophysical Log | Digital photos

Well ID: Jc23-02
Easting: 446042.5
Northing: 4332757.5
Altitute: 58.00
Hyd Unit: Not Available



clay; silty; Trace: organic material, fine sand, fine gravel
clay; silty; Trace: fine sand, fine gravel
fine to medium sand; silty; very thin (1-3 cm) interlace: clay, silt
fine to medium sand; Trace: silt; very thin (1-3 cm) interlace: fine to medium sand; :
coarse to medium sand; fine to very coarse gravelly; Trace: silt
coarse to medium sand; Trace: gravel, silt
medium to coarse sand; Trace: silt; very thin (1-3 cm) interlace: silty
coarse to medium sand; gravelly; Trace: silt
medium to coarse sand; Trace: silt; very thin (1-3 cm) interlace: fine to medium san
fine to medium sand; Trace: silt
sand; silty
fine to medium sand; Trace: silt

Start Depth	Stop Depth	Description
0.00	1.00	clay; silty; Trace: organic material, fine sand, fine gravel
1.00	3.50	clay; silty; Trace: fine sand, fine gravel
3.50	7.00	fine to medium sand; silty; very thin (1-3 cm) interlace: clay, silt
7.00	17.00	fine to medium sand; Trace: silt; very thin (1-3 cm) interlace: fine to medium sand; silty
17.00	25.00	coarse to medium sand; fine to very coarse gravelly; Trace: silt
25.00	29.00	coarse to medium sand; Trace: gravel, silt
30.00	33.00	medium to coarse sand; Trace: silt; very thin (1-3 cm) interlace: silty
33.00	35.00	coarse to medium sand; gravelly; Trace: silt
35.00	41.00	medium to coarse sand; Trace: silt; very thin (1-3 cm) interlace: fine to medium sand; silty
41.00	45.00	fine to medium sand; Trace: silt
45.00	47.00	sand; silty

Available data layers

Select / search data layers

Base Map Data
Groundwater – Point Observations
Groundwater Observations and Hydrographs
undwater Observations
s with Lithologic Logs
s with Downhole Geophysical Logs
lwater - Area and Gridded Data
lhead Protection Areas
t/Sussex Groundwater Recharge Potential
v Castle County Recharge RPAs
th to Water - Dry Conditions
th to Water - Normal Conditions

layers

Uncheck all | Remove all

undwater Observations and Hydrographs
v Castle County Recharge RPAs
Map 12 Cape Henlopen
undwater Observations
Map 14 Kent County
Map 10 App Piedmont
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dwater Hydrograph Sites
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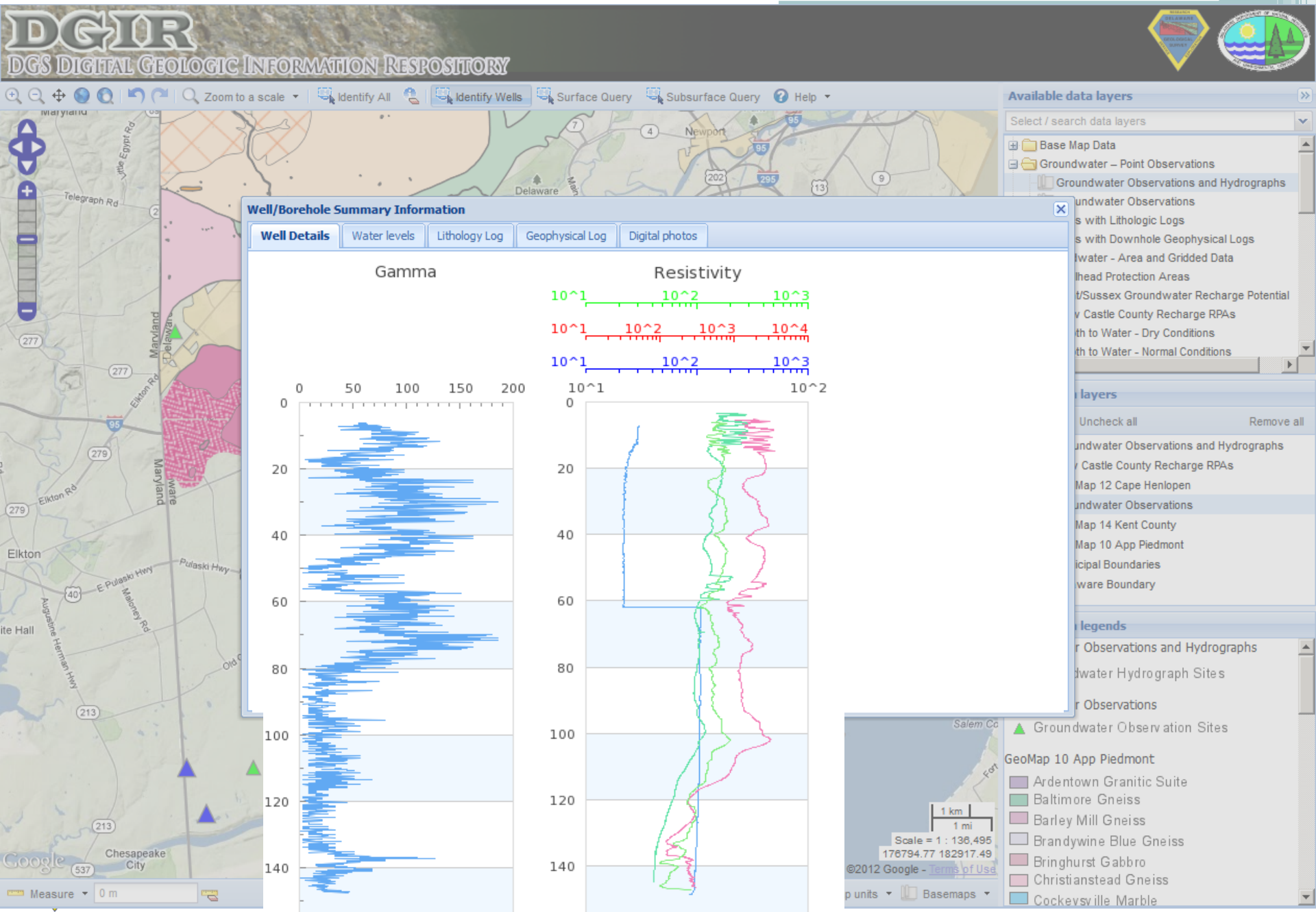
dywine Blue Gneiss
lhurst Gabbro
tianstead Gneiss
evsville Marble

Measure | 0 m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Lithology Log
Geophysical Log
Digital photos
Gamma
Resistivity
10^1
10^2
10^3
10^4
0
50
100
150
200
20
40
60
80
100
120
140
Uncheck all
Remove all
Groundwater Observation Sites
GeoMap 10 App Piedmont
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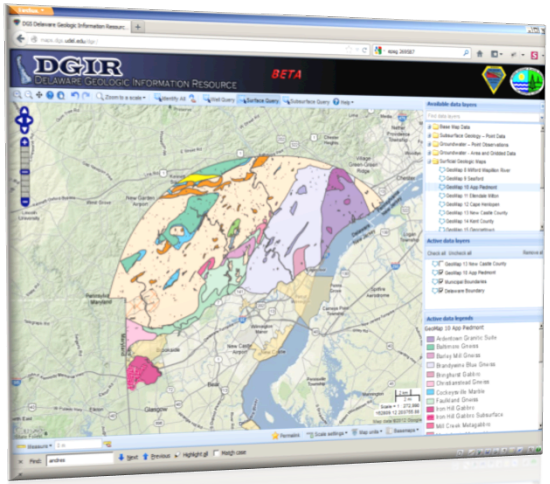
Baltimore Gneiss
Barley Mill Gneiss
Brandywine Blue Gneiss
Bringhurst Gabbro
Christianstead Gneiss
Cockeysville Marble
Newport
Delaware
Maryland
Elkton
Chesapeake City
Telegraph Rd
Elkton Rd
Pulaski Hwy
E Pulaski Hwy
Maloney Rd
Augustine Herman Hwy
Measure
Basemaps
Google

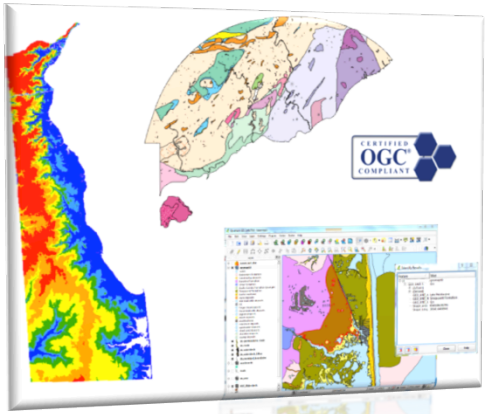
Delaware Geologic Information Resource - DGIR -

Map Viewer



Metadata Catalog

Web Services



+USGIN… All working together!

Next Steps

- Consolidate NGDS metadata and map services onto local servers (USGIN node)
- NGDS/USGIN Node-In-A-Box (NIAB) application
  - Possible replacement for metadata process
- Integrate DGS digital data publication workflow with USGIN requirements
  - Google is your friend….
  - …but so are Linked Data/RDFa and web services.
  - Can't we all just get along?

Questions? Comments?

John Callahan
Delaware Geological Survey
john.callahan@udel.edu