



Pghydro Project: PostgreSQL-PostGIS Extension to Assist in Water Resources Decision Making

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Introduction

- ▶ Database Extension for PostgreSQL/PostGIS
 - ▶ Schemes
 - ▶ Tables
 - ▶ Queries
 - ▶ Functions
 - ▶ Developed using PLPGSQL



Main Purpose

- ▶ Create a Hydrographic Dataset to help on Water Resources Decision Making using GIS:

Otto-codified Hydrographic
Dataset(OHD)



DRAINAGE
LINES



DRAINAGE
LINES
CONSISTED

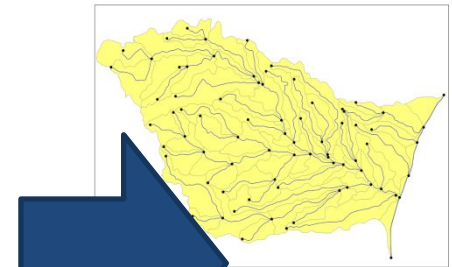
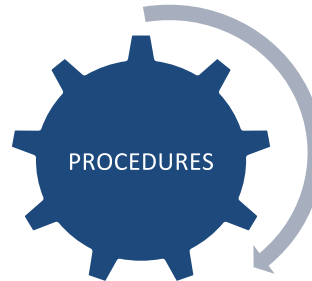


DRAINAGE
AREAS



DRAINAGE
AREAS
CONSISTED

1:1



Identificar Resultados	Valor
dr_pk	dr_techodragon
dr	dr
dr_desc	
dr_desc1	779411
desc_desc1	
desc_desc2	7794
desc_desc3	7794_0
desc_desc4	dr
dr_pk	dr
dr_desc	840 Rio Jaenes versal 2.0 de 1988/2014
desc_desc	Jaenes
desc_desc1	210
desc_desc2	
desc_desc3	1010
desc_desc4	dr Jaenes
desc_desc5	dr Jaenes
desc_desc6	24.1254619113
desc_desc7	0.16113751125
desc_desc8	24.1254619113
desc_desc9	46.46100001017
desc_desc10	88.22619511177
desc_desc11	0.2091654622942
desc_desc12	0
desc_desc13	0
desc_desc14	0
desc_desc15	0
desc_desc16	7
desc_desc17	1
desc_desc18	0

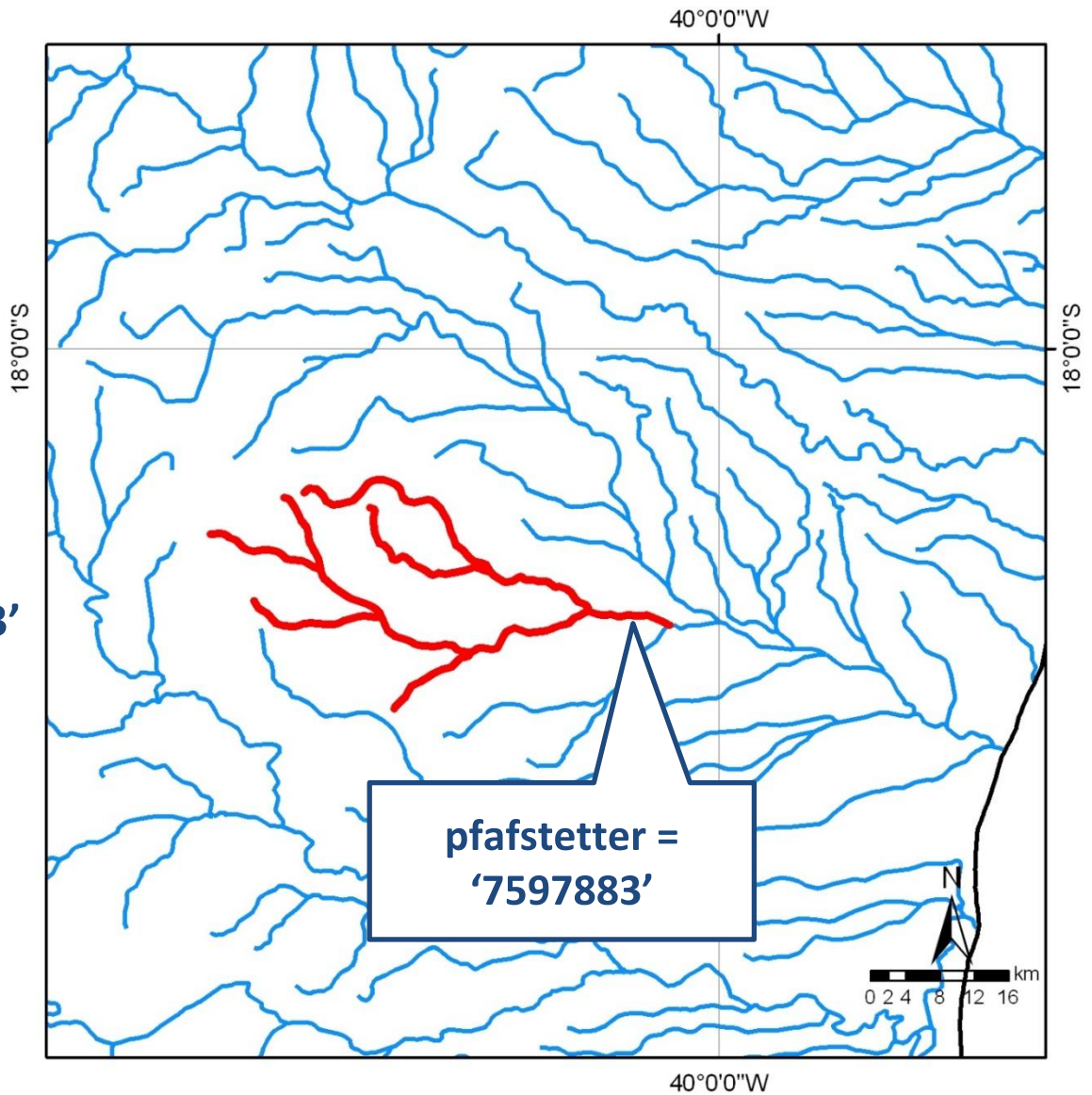


Otto-codified Hydrographic Dataset (OHD)

- ▶ Pfafstetter basin coding;
- ▶ Pfafstetter watercourse coding;
- ▶ Reach Length;
- ▶ Watercourse Length;
- ▶ Drainage Area;
- ▶ Upstream Drainage Area;
- ▶ Distance to the sea;
- ▶ Distance to the basin outlet;
- ▶ Drainage Line Flux Direction;
- ▶ Upstream Reach;
- ▶ Downstream Reach;
- ▶ Converging Reach;
- ▶ Watercourse order;
- ▶ Strahler Order;
- ▶ Pfafstetter Basin Level;
- ▶ Pfafstetter Watercourse Level;



```
SELECT *  
FROM DRAINAGE_LINE  
WHERE "pfafstetter" >= '7597883'  
AND "pfafstetter" like '759788%'  
ORDER by "pfafstetter";
```





Main Characteristics

- PostgreSQL/PostGIS Extension;
- Open Source Code (Collaborative);
- The intelligence is located in the Database System;
- You can edit your dataset using any GIS (since you are able to edit geometric features in PostGIS);



PgHydro Project

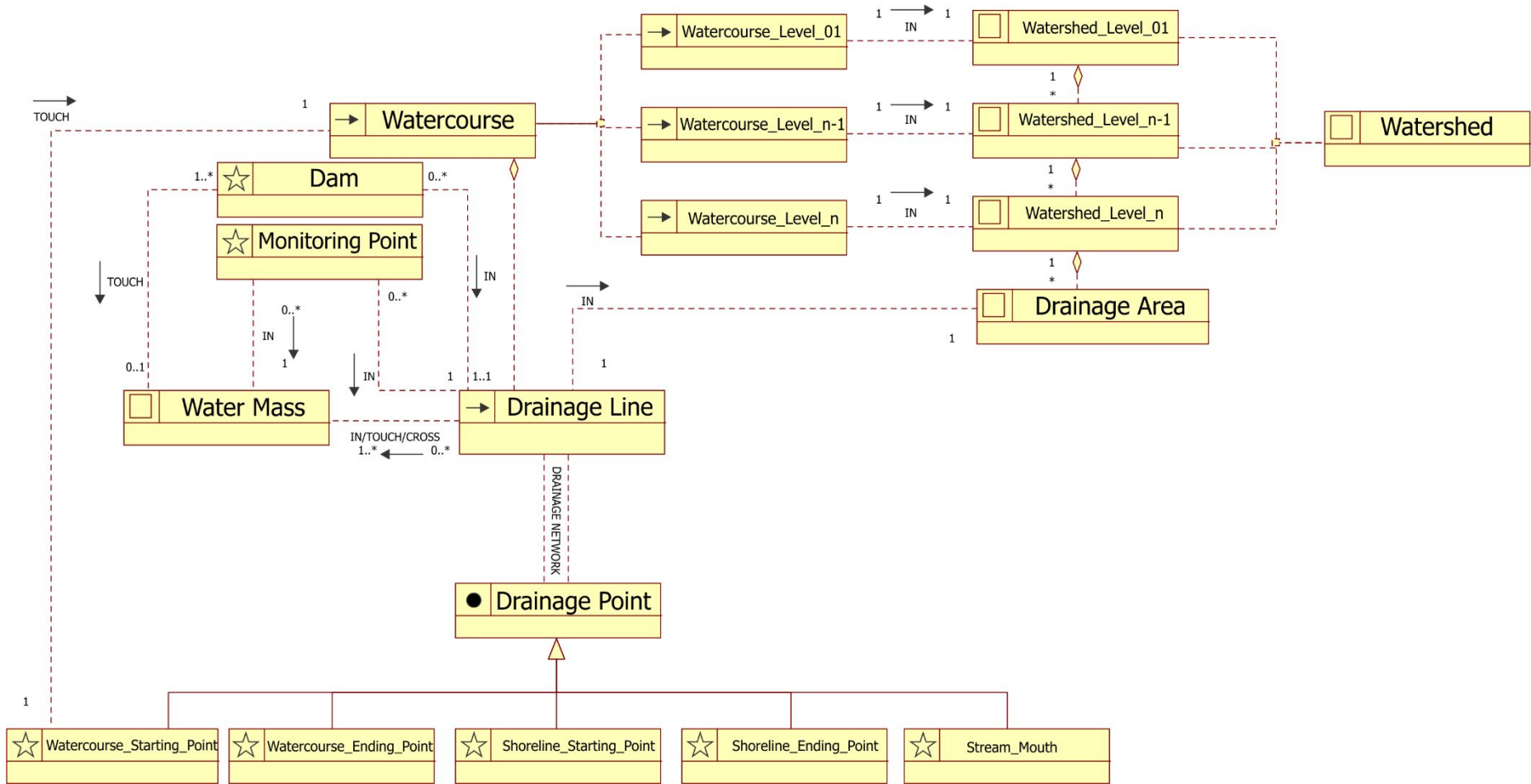




PgHydro 6.0

Database Scheme





Conceptual Model (OMT-G)



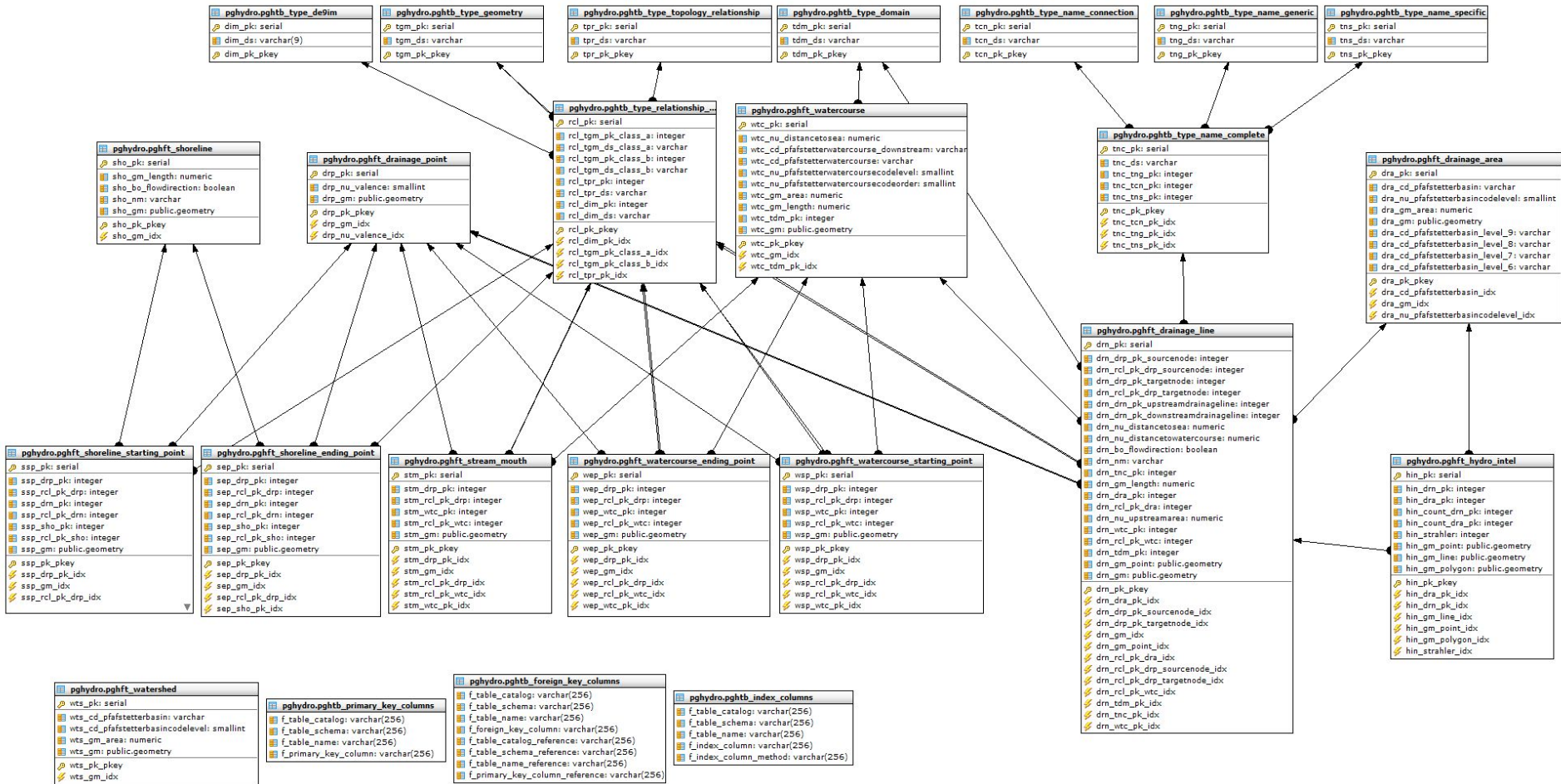
pghydro.pghft_watercourse	
🔑	wtc_pk: serial
📄	wtc_nu_distancetosea: numeric
📄	wtc_cd_pfafstetterwatercourse_do...
📄	wtc_cd_pfafstetterwatercourse: v...
📄	wtc_nu_pfafstetterwatercoursecod...
📄	wtc_nu_pfafstetterwatercoursecod...
📄	wtc_gm_area: numeric
📄	wtc_gm_length: numeric
📄	wtc_tdm_pk: integer
📄	wtc_gm: public.geometry
🔑	wtc_pk_pkey
⚡	wtc_gm_idx
⚡	wtc_tdm_pk_idx

pghydro.pghft_drainage_line	
🔑	drn_pk: serial
📄	drn_drp_pk_sourcenode: integer
📄	drn_rcl_pk_drp_sourcenode: integer
📄	drn_drp_pk_targetnode: integer
📄	drn_rcl_pk_drp_targetnode: integer
📄	drn_drn_pk_upstreamdrainageline...
📄	drn_drn_pk_downstreamdrainageli...
📄	drn_nu_distancetosea: numeric
📄	drn_nu_distancetowatercourse: n...
📄	drn_bo_flowdirection: boolean
📄	drn_nm: varchar
📄	drn_tnc_pk: integer
📄	drn_gm_length: numeric
📄	drn_dra_pk: integer
📄	drn_rcl_pk_dra: integer
📄	drn_nu_upstreamarea: numeric
📄	drn_wtc_pk: integer
📄	drn_rcl_pk_wtc: integer
📄	drn_tdm_pk: integer
📄	drn_gm_point: public.geometry
📄	drn_gm: public.geometry
🔑	drn_pk_pkey
⚡	drn_dra_pk_idx
⚡	drn_drp_pk_sourcenode_idx
⚡	drn_drp_pk_targetnode_idx
⚡	drn_gm_idx
⚡	drn_gm_point_idx
⚡	drn_rcl_pk_dra_idx
⚡	drn_rcl_pk_drp_sourcenode_idx
⚡	drn_rcl_pk_drp_targetnode_idx
⚡	drn_rcl_pk_wtc_idx
⚡	drn_tdm_pk_idx
⚡	drn_tnc_pk_idx
⚡	drn_wtc_pk_idx

pghydro.pghft_drainage_point	
🔑	drp_pk: serial
📄	drp_nu_valence: smallint
📄	drp_gm: public.geometry
🔑	drp_pk_pkey
⚡	drp_gm_idx
⚡	drp_nu_valence_idx

pghydro.pghft_drainage_area	
🔑	dra_pk: serial
📄	dra_cd_pfafstetterbasin: varchar
📄	dra_nu_pfafstetterbasincodelevel:...
📄	dra_gm_area: numeric
📄	dra_gm: public.geometry
📄	dra_cd_pfafstetterbasin_level_9: ...
📄	dra_cd_pfafstetterbasin_level_8: ...
📄	dra_cd_pfafstetterbasin_level_7: ...
📄	dra_cd_pfafstetterbasin_level_6: ...
🔑	dra_pk_pkey
⚡	dra_cd_pfafstetterbasin_idx
⚡	dra_gm_idx
⚡	dra_nu_pfafstetterbasincodelevel:...

Physical Core Model



Physical Scheme



PgHydro 6.0

Database Tools





Database Tools

- Queries;
- Functions;
- Triggers;
- Indexes;



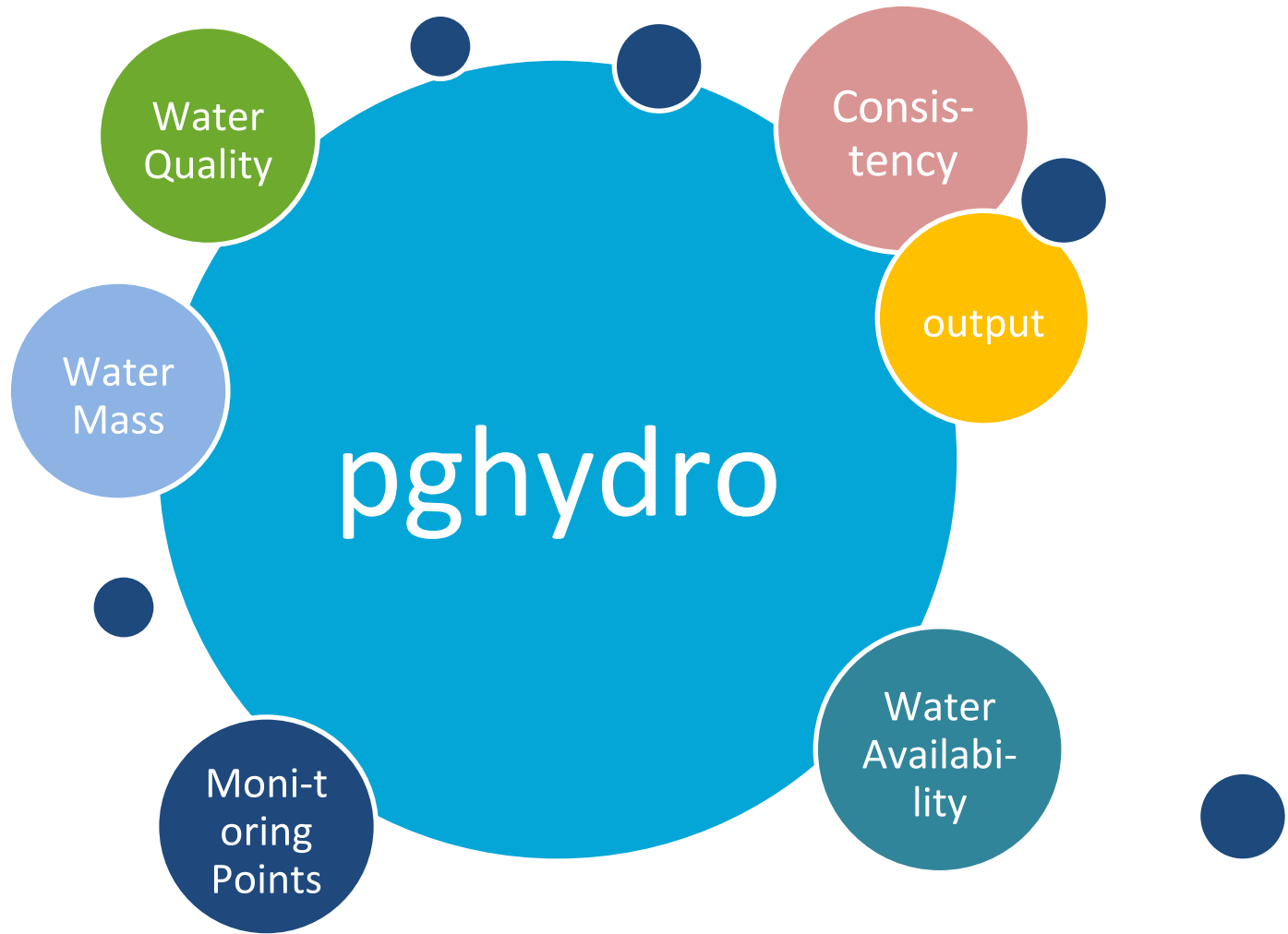
Database Tools

- Query Functions
 - Geometry Consistency;
 - Topological Consistency
 - User Consistency;
- Procedure Functions



pgHydro: Objetos Hidrográficos em SGBDG

- Query Functions:
 - Downstream reaches until the sea;
 - Distance to the sea;
 - Upstream Reaches;
 - Upstream Area;
 - Upstream Reach;
 - Downstream Reach;
 - Main basin reaches;
 - Pfstetter's basin coding;





Add PostGIS Table(s)

? X

Connections

amazon

Connect New Edit Delete Load Save

Schema	Table	Comment	Column	Data Type	Spatial Type	SRID
⊕ pgh_consistency						
⊕ pgh_output						
⊕ pghydro						
⊕ public						

Also list tables with no geometry Keep dialog open
 Search options

Add Set Filter Close Help



Add PostGIS Table(s)

? X

Connections

amazon

Connect

New

Edit

Delete

Load

Save

Schema	Table	Comment	Column	Data Type	Spatial Type	SRID
pg_h consistency						
pg_h output						
pghydro						
pghydro	pghft_drainage_area		dra_gm	Geometry	MultiPolygon	Enter...
pghydro	pghft_drainage_line		drn_gm	Geometry	MultiLineString	Enter...
pghydro	pghft_drainage_line		drn_gm_point	Geometry	MultiPoint	Enter...
pghydro	pghft_drainage_point		drp_gm	Geometry	Point	Enter...
pghydro	pghft_hydro_intel		hin_gm_line	Geometry	MultiLineString	Enter...
pghydro	pghft_hydro_intel		hin_gm_point	Geometry	Point	Enter...
pghydro	pghft_hydro_intel		hin_gm_polygon	Geometry	MultiPolygon	Enter...
pghydro	pghft_shoreline		sho_gm	Geometry	MultiLineString	Enter...
pghydro	pghft_shoreline_ending_point		sep_gm	Geometry	Point	Enter...
pghydro	pghft_shoreline_starting_point		ssp_gm	Geometry	Point	Enter...
pghydro	pghft_stream_mouth		stm_gm	Geometry	Point	Enter...
pghydro	pghft_watercourse		wtc_gm	Geometry	MultiLineString	Enter...
pghydro	pghft_watercourse_ending_point		wep_gm	Geometry	Point	Enter...
pghydro	pghft_watercourse_starting_point		wsp_gm	Geometry	Point	Enter...
pghydro	pghft_watershed		wts_gm	Geometry	MultiPolygon	Enter...
public						

Also list tables with no geometry

Keep dialog open

Search options

Add

Set Filter

Close

Help

pgAdmin III

File Edit Plugins View Tools Help

Object browser

- pghfn_main_watercourse_confluences(integer)
- pghfn_main_watercourse_confluences(integer, integer)
- pghfn_main_watercourse_drainagelines(integer)
- pghfn_main_watercourse_drainagelines(integer, integer)
- pghfn_numdownstreamdrainagelines(integer)
- pghfn_numpfafstetterbasincodelevel()
- pghfn_numupstreamdrainagelines(integer)
- pghfn_pfafstetter_codification(integer, integer)
- pghfn_pfafstetter_codifications(integer, integer)
- pghfn_pfafstetterbasincodelevel()
- pghfn_pfafstetterbasincodeleveln(integer)
- pghfn_reversedrainageline()
- pghfn_turnoffkeysindex()
- pghfn_turnonkeysindex()
- pghfn_updatedomaincolumn()
- pghfn_updategeometrysruid()
- pghfn_updatepfafstetterbasincode(character varying)
- pghfn_updatepfafstetterwatercoursecode()
- pghfn_updateshoreline()
- pghfn_updateshorelineendingpoint(integer)
- pghfn_updateshorelinestartingpoint(integer)
- pghfn_updatestream_mouth()
- pghfn_updatewatercourse()
- pghfn_updatewatercourse_ending_point()
- pghfn_updatewatercourse_starting_point()
- pghfn_updatewatershed(integer)
- pghfn_updatewatersheddrainagearea(integer)
- pghfn_upstreamdrainageline(integer)
- pghfn_upstreamdrainagelines(integer)
- pghfn_upstreamdrainagelines(integer, integer)
- pghfn_upstreamdrainagelinesarea(integer)
- pghfn_upstreamdrainagelinesn(integer, integer)
- pghfn_valence(integer)
- pghfn_variabletosea(integer, character varying, character var
- pghfn_variableupstream(integer, character varying, character

Sequences (21)
Tables (24)
Trigger Functions (0)
Views (0)

Properties Statistics Dependencies Dependents

Property	Value
Name	pghfn_upstreamdrainagelines
OID	3307175
Owner	postgres
Argument count	1
Arguments	integer

SQL pane

```
-- Function: pghydro.pghfn_upstreamdrainagelines(integer)
-- DROP FUNCTION pghydro.pghfn_upstreamdrainagelines(integer);

CREATE OR REPLACE FUNCTION pghydro.pghfn_upstreamdrainagelines(integer)
  RETURNS SETOF integer AS
  $BODY$
  DECLARE
    r record;
  BEGIN
    FOR r IN
    WITH RECURSIVE upstream(drn_pk, drn_drp_pk_targetnode, drn_drp_pk_sourcenode) AS (
      SELECT drn_pk, drn_drp_pk_targetnode, drn_drp_pk_sourcenode
      FROM pghydro.pghft_drainage_line
      WHERE drn_pk = $1
      UNION ALL
      SELECT a.drn_pk, a.drn_drp_pk_targetnode, a.drn_drp_pk_sourcenode
      FROM pghydro.pghft_drainage_line a, upstream c
      WHERE a.drn_drp_pk_targetnode = c.drn_drp_pk_sourcenode
    )
    SELECT drn_pk
    FROM upstream
    LOOP
      RETURN NEXT r.drn_pk;
    END LOOP;
    RETURN;
  END;
  $BODY$
  LANGUAGE plpgsql VOLATILE
  COST 100
  ROWS 1000;
```

Retrieving details on function pghfn_upstreamdrainagelines... Done.

0.00 secs



pgAdmin III

File Edit Plugins View Tools Help

Object browser

- amazon
 - Catalogs (2)
 - Event Triggers (0)
 - Extensions (5)
 - Schemas (4)
 - pgh_consistency
 - pgh_output
 - Collations (0)
 - Domains (0)
 - FTS Configurations (0)
 - FTS Dictionaries (0)
 - FTS Parsers (0)
 - FTS Templates (0)
 - Functions (1)
 - Sequences (0)
 - Tables (5)
 - geoft_bho_area_drenagem
 - geoft_bho_curso_dagua
 - geoft_bho_linha_costa
 - geoft_bho_ponto_drenagem
 - geoft_bho_trecho_drenagem
 - Trigger Functions (0)
 - Views (0)
 - pghydro
 - public
 - Slony Replication (0)

```
-- Table: pgh_output.geoft_bho_trecho_drenagem
-- DROP TABLE pgh_output.geoft_bho_trecho_drenagem;

CREATE TABLE pgh_output.geoft_bho_trecho_drenagem
(
  drn_pk integer,
  cotrecho integer,
  noorigem integer,
  nodestino integer,
  cocursodag character varying,
  cobacia character varying,
  nucomptrec numeric,
  nudistbact numeric,
  nudistcdag numeric,
  nuareacont numeric,
  nuareamont numeric,
  nogenerico character varying,
  nologacao character varying,
  noespecif character varying,
  noriocomp character varying,
  nooriginal character varying,
  cocdadesag character varying,
  nutrjus integer,
  nudistbacc numeric,
  nuareabacc numeric,
  nuordemcda smallint,
  nucompcda numeric,
  nunivotto smallint,
  nunivotcda smallint,
  nuatrablex integer
)
```

Retrieving details on table geoft_bho_trecho_drenagem... Done. 0.04 secs

Query - amazon on postgres@localhost:5433 *

File Edit Query Favurites Macros View Help

amazon on postgres@localhost:5433

SQL Editor Graphical Query Builder

Previous queries Delete Delete All

```
--=====
--INPUT DATA
--=====

SELECT pghydro.pghfn_input_data_drainage_line('public', 'input_drainage_line', 'geom', 'nome');

SELECT pghydro.pghfn_input_data_drainage_area('public', 'input_drainage_area', 'geom');

--'nome' - column name;
--IF there is no column name: SELECT pghydro.pghfn_input_data_drainage_line('public', 'input_draina

--=====
--PROCESS 3.1
--=====

--Check_DrainageLineGeometryConsistencies

DROP INDEX IF EXISTS pghydro.drn_gm_idx;

ALTER TABLE pghydro.pghft_drainage_line DROP CONSTRAINT IF EXISTS drn_pk_pkey;

SELECT pgh_consistency.pghfn_MakeSnapToGridDrainageLine(0.0000001);

SELECT pgh_consistency.pghfn_removepeatedpointsdrainageline();
```

Output pane

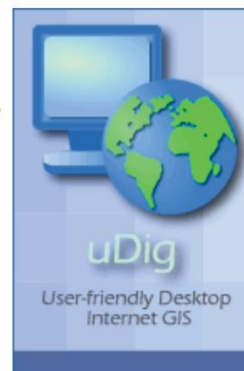
Data Output Explain Messages History

ready DOS Ln 814, Col 40, Ch 26731

TerraView



Arc
ESRI GIS™



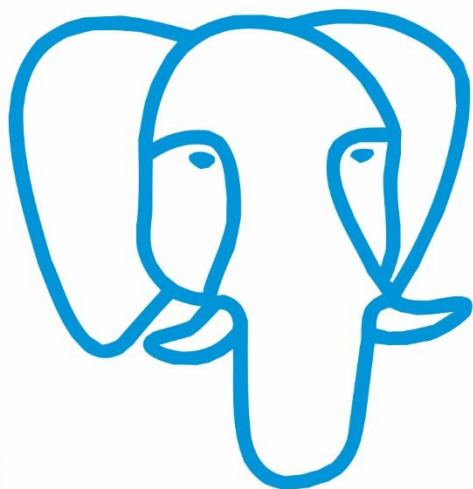
PgHydro

Hydrographic Objects for PostgreSQL



PostGIS

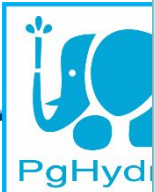
Geographic Objects for PostgreSQL



PostgreSQL



PgHydro Tools (QGIS Plugin)



Pghydro Tools

Conectar SBDE | Importar Dados | Consistir Drenagem | Consistir Arco-Nó | Consistir Bacia | Drenagem x Bacia

1 - Informações da Conexão

Máquina: localhost

Porta: 5433

Base de dados: amazon

Esquema: pghydro

Usuário: postgres

Senha: ●●●●●●

Criar Banco de Dados Espaciais e PgHydro Schema

Conectar

Console

```
09.08.2017 - 10:44:38
Extensao PgHydro Criada Com Sucesso!

09.08.2017 - 10:44:40
Extensao PgHydro Consistency Criada Com Sucesso!

09.08.2017 - 10:44:41
Extensao PgHydro Output Criada Com Sucesso!

09.08.2017 - 10:44:41
Banco de Dados Espaciais e Extensoes do PgHydro Criadas Com Sucesso!
```



Pghydro Tools

Conectar SBDE | Importar Dados | Consistir Drenagem | Consistir Arco-Nó | Consistir Bacia | Drenagem x Bacia

2 - Importar Dados para o PgHydro Schema

Drenagem

Tabela Geométrica

Atributo Com Nome

Importar Drenagem

Bacia

Tabela Geométrica

Importar Bacia

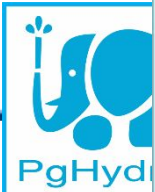
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Pghydro Tools

Conectar SBDE | Importar Dados | **Consistir Drenagem** | Consistir Arco-Nó | Consistir Bacia | Drenagem x Bacia

3.1 - Consistência Geométrica

PRECISÃO:

Geometria Não Simples

Geometria Não Válida

Geometria Não Única

OFFSET(drn_pk):

3.2 - Consistência Topológica

Geometria Dentro de Geometria

Geometria Sobreposição Geometria

Geometria Com Loop

3.3 - Consistência Topológica

Geometria Cruza Geometria

Geometria Toca Geometria

Console

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Banco de Dados Espaciais e Extensoes do PgHydro Criadas Com Sucesso!



Pghydro Tools

-Nó Consistir Bacia Drenagem x Bacia Informações Hidrográficas Finais Atualizar Dados de Saída Hidronímia

7 - Gerar Informações Hidrográficas Finais

Processamento Principal

- Atualizar Comprimento da Drenagem SRID: 29100 Fator: 1000
- Atualizar Área da Bacia Hidrográfica SRID: 29100 Fator: 1000000
- Calcular Distância à Foz da Bacia: 0
- Calcular Área a Montante
- Atualizar Drenagem a Montante
- Atualizar Drenagem a Jusante
- Codificar Bacias de Otto Pfafstetter
- Atualizar Código de Bacia de Otto Pfafstetter
- Atualizar Código de Curso D'Água de Otto Pfafstetter
- Atualizar Curso D'Água
- Inserir as Colunas com Codificação de Bacias de Otto Pfafstetter
- Atualizar Pontos de Cursos D'Água
- Calcular Ordem de Strahler
- Atualizar Linha de Costa (se for o caso)

Ligar Índices, PKs e FKs

Atualizar Dominialidade (opcional)

Atualizar Agregação de Bacias

Processar

Console

09.08.2017 - 10:44:38
Extensao PgHydro Criada Com Sucesso!

09.08.2017 - 10:44:40
Extensao PgHydro Consistency Criada Com Sucesso!

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Banco de Dados Espaciais e Extensoes do PgHydro Criadas Com Sucesso!



Pghydro Tools

? X

-Nó Consistir Bacia Drenagem x Bacia Informações Hidrográficas Finais Atualizar Dados de Saída Hidronímia

8 - Atualizar Dados de Saída

Processar

Console

09.08.2017 - 10:44:38
Extensao PgHydro Criada Com Sucesso!

09.08.2017 - 10:44:40
Extensao PgHydro Consistency Criada Com Sucesso!

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Extensao PgHydro Output Criada Com Sucesso!

09.08.2017 - 10:44:41
Banco de Dados Espaciais e Extensoes do PgHydro Criadas Com Sucesso!



PgHydro

Main Characteristics

Visualization in GIS

Complex SQL Queries

Very Large SQL Queries

Domain Tables

Normalized Tables

Indexed columns (spatial and non-spatial data)

Hydrographic Functions

Multi-user editing

Data Security

Data Backup

Otto-codified Hydrographic Dataset (OHD)

Main Characteristics

Visualization in GIS

Simple Queries using GIS SQL

Easy Manipulation and dissemination

Redundant Information



PgHydro Project

pghydro

Add a bio

PgHydro Project
Brasília, Federal District, Brazil
pghydro.project@gmail.com
http://www.pghydro.org

Overview **Repositories 2** Stars 0 Followers 2 Following 0

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Customize your pinned repositories

pghydro

PgHydro extends the PostGIS/PostgreSQL geospatial database to provide drainage network analysis functionality to help on water resources decision making.

PLpgsql ★ 2

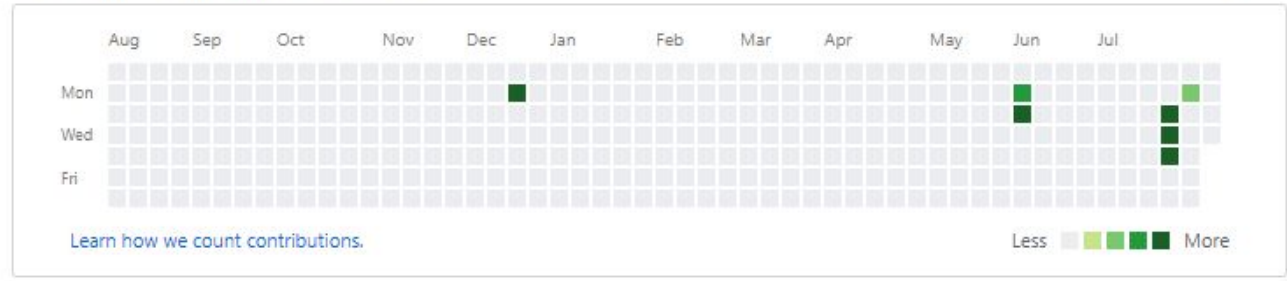
pghydrotools

QGIS PgHydroTools Plugin is an interface used in QGIS to activate all functionality of PgHydro Extension for PostgreSQL/PostGIS.

Python ★ 1

128 contributions in the last year

Contribution settings



pghydro / pghydro

Unwatch 1 Star 2 Fork 0

Code Issues 0 Pull requests 0 Projects 0 Wiki Settings Insights

PgHydro extends the PostGIS/PostgreSQL geospatial database to provide drainage network analysis functionality to help on water resources decision making. Edit

Add topics

52 commits 2 branches 1 release 1 contributor GPL-2.0

Branch: master New pull request Create new file Upload files Find file Clone or download

pghydro committed on GitHub Update README.md	Latest commit d94400b 9 days ago
CNAME	Create CNAME 13 days ago
LICENSE	Initial commit 8 months ago
README.md	Update README.md 9 days ago
README.txt	Add files via upload 13 days ago
_config.yml	Set theme jekyll-theme-minimal 2 months ago
pgh_consistency--6.0.sql	Add files via upload 13 days ago
pgh_consistency.control	Add files via upload 13 days ago
pgh_output--6.0.sql	Add files via upload 13 days ago
pgh_output.control	Add files via upload 13 days ago
pghydro--6.0.sql	Add files via upload 13 days ago
pghydro.control	Add files via upload 13 days ago

INTRODUCTION

PgHydro extends the PostGIS/PostgreSQL geospatial database to provide drainage network analysis functionality to support decision making in Water Resources.

Hydrographic objects are all tables, constraints, procedures, queries, functions or views developed in PostGIS/PostgreSQL in order to build a consistent river network and calculates the correct direction of flow vector water, Otto Pfafstetter's basin coding system, selection of upstream/downstream stretches, distance to the the mouth of the basin, upstream calculation area, river orders, basin levels, and other information to assist in decision making in water resources.

REQUIREMENTS

Postgresql version = postgresql-9.3.5-3-windows-x64

(<https://drive.google.com/file/d/0B2u6WhefYxhZMmlPazUwR2pZYWs/view?usp=sharing>)

PostGIS version = postgis-bundle-pg93x64-setup-2.1.4-1

(<https://drive.google.com/file/d/0B2u6WhefYxhZdTlyVIRBWlIPeXc/view?usp=sharing>)

INSTALLATION (v.6.0)

Download the files below and copy the content to \PostgreSQL\x.x\share\extension

(<https://drive.google.com/drive/folders/0B2u6WhefYxhZNTlyMXdFaFhqOVk?usp=sharing>)

Postgresql 9.1+

```
createdb mydatabase
psql mydatabase -c "CREATE EXTENSION postgis"
psql mydatabase -c "CREATE EXTENSION pghydro"
psql mydatabase -c "CREATE EXTENSION pghconsistency"
psql mydatabase -c "CREATE EXTENSION pgh_output"
```

Notes

Alexandre

pghydro/pghydrotools: x

GitHub, Inc. [US] | https://github.com/pghydro/pghydrotools

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pghydro / pghydrotools

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QGIS PgHydroTools Plugin is an interface used in QGIS to activate all functionality of PgHydro Extension for PostgreSQL/PostGIS. Edit

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Logo_quadrada.png	Add files via upload	15 days ago
Makefile	Add files via upload	15 days ago
README.html	Add files via upload	15 days ago
README.md	Update README.md	9 days ago
README.txt	Add files via upload	15 days ago
init.py	Add files via upload	15 days ago
_icon.png	Add files via upload	15 days ago

QGIS Python Plugins Repository

https://plugins.qgis.org/plugins/PghydroTools/

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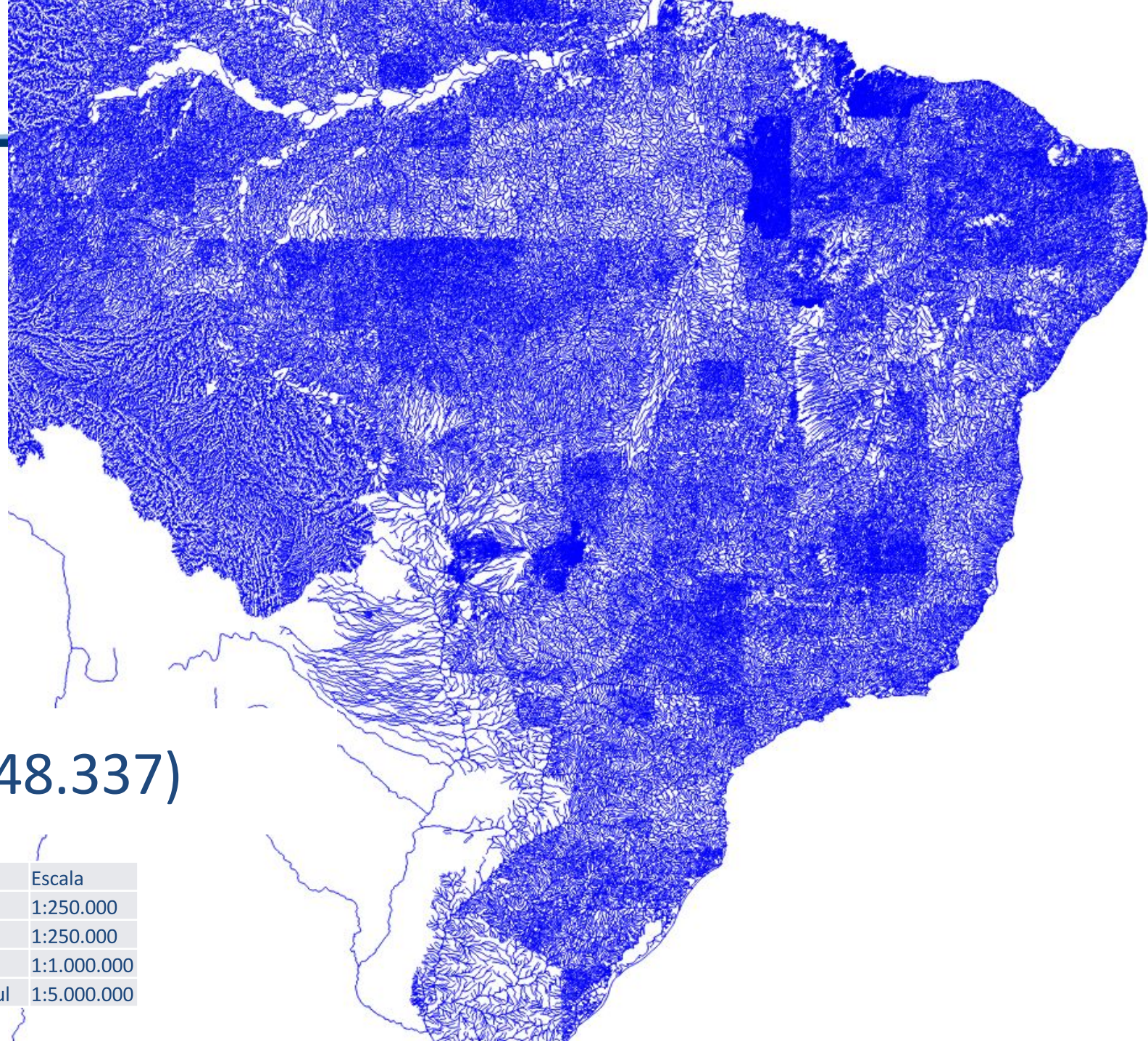
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PgHydro Tools Interface for PgHydro Extension for PostgreSQL/PostGIS

About Details Versions

Version	Experimental	Minimum QGIS version	Downloads	Uploaded by	Date
2.0.2	yes	2.0.0	62	pghydro	Aug. 3, 2017, 2:46 p.m.
2.0.1	no	2.0.0	218	pghydro	July 26, 2017, 10:23 a.m.
2.0	no	2.0.0	119	pghydro	July 25, 2017, 2:04 p.m.
1.1	no	2.0.0	0	pghydro	June 29, 2016, 9:52 a.m.
0.1	yes	2.0.0	18	pghydro	June 28, 2016, 1:02 p.m.



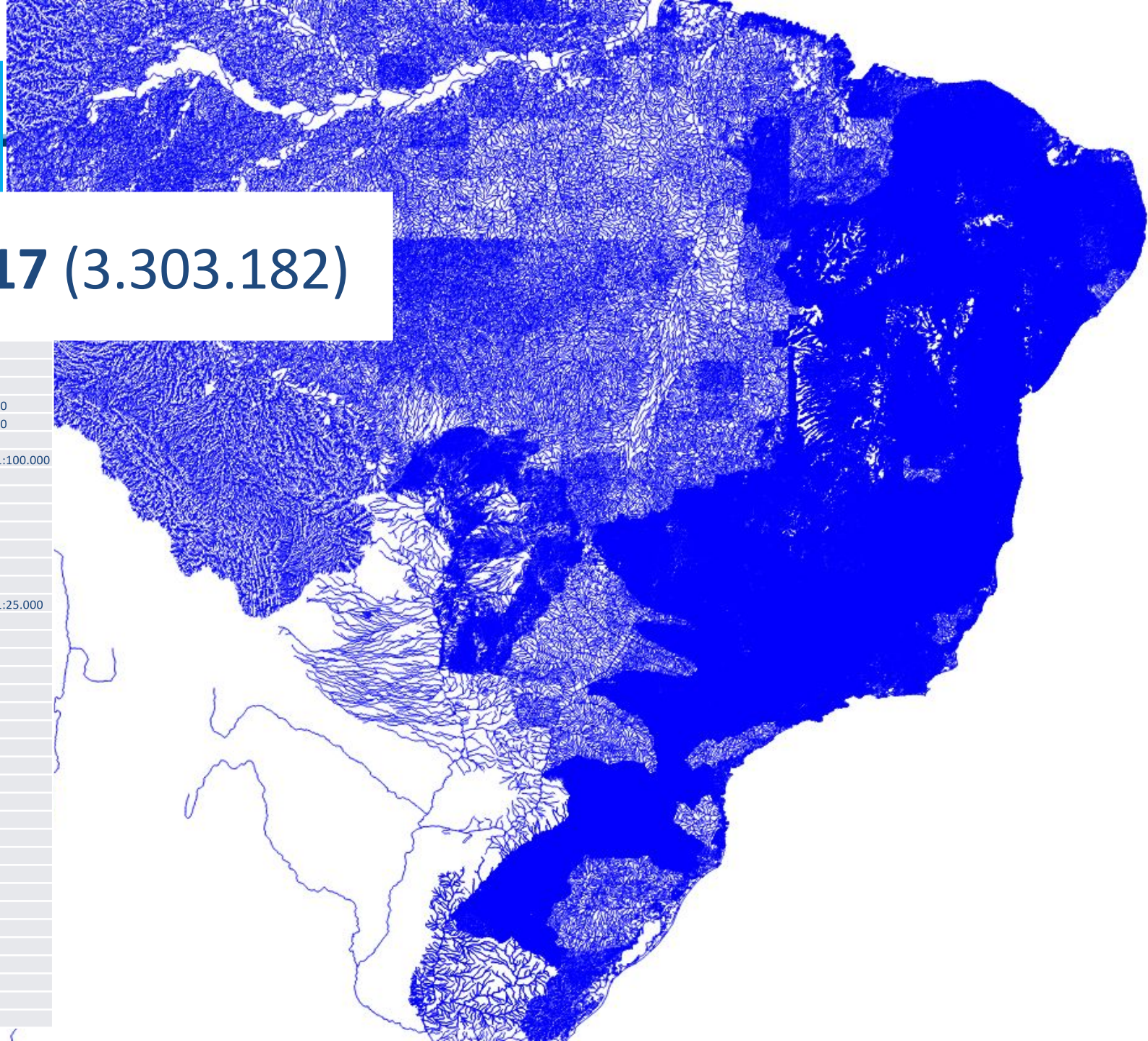
2008 (248.337)

BHO 2012	Escala
Estado do Maranhão	1:250.000
Bacia do Rio Taquari	1:250.000
Resto do Brasil	1:1.000.000
Resto da América do Sul	1:5.000.000



BHO 2017 (3.303.182)

BHO 2017	Escala
Estado do Maranhão	1:250.000
Bacia do Rio Taquari	1:250.000
Resto do Brasil	1:1.000.000
Resto da América do Sul	1:5.000.000
Estados do PISF	1:100.000
Bacia do Rio Doce	1:50.000/1:100.000
Bacia do Paraíba do Sul	1:250.000
Bacias dos Rio Tietê	1:50.000
Bacia do Rio Paranaíba	1:100.000
Bacia do Rio Paranapanema	1:50.000
Bacia do Rio Grande	1:50.000
Bacia do Rio Paraguai	1:250.000
Bacia do Rio Iguazu	1:50.000
Bacia do Rio Uruguai	1:50.000/1:25.000
Bacia do Rio São Francisco	1:100.000
Bacia do Rio Parnaíba	1:100.000
Bacia do Rio Contas	1:100.000
Bacia do Rio Itabapoana	1:250.000
Bacia do Rio Itapicuru	1:100.000
Bacia do Rio Itaunas	1:250.000
Bacia do Rio Mirim	1:250.000
Bacia do Rio Negro	1:250.000
Bacia do Rio Paraguaçu	1:100.000
Bacia do Rio Paraná	1:250.000
Bacia do Rio Preto	1:250.000
Bacia do Rio Quaraí	1:250.000
Bacia do Rio Salitre	1:100.000
Bacia do Rio São Mateus	1:250.000
Bacia do Rio Uruçuia	1:250.000
Bacia do Rio Jequitinhonha	1:100.000
Bacia do Rio Pardo	1:100.000
Bacia do Rio Mucuri	1:100.000
Bacia do Rio Itanhém	1:100.000
Bacia do Rio Jucuruçu	1:100.000
Bacia do Rio Real	1:100.000
Bacia do Rio Vaza-Barris	1:100.000
Bacia do Rio Sergipe	1:100.000





Thank You!

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www.pghydro.org

github.com/pghydro