



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

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National Water Agency of Brazil





# Introduction

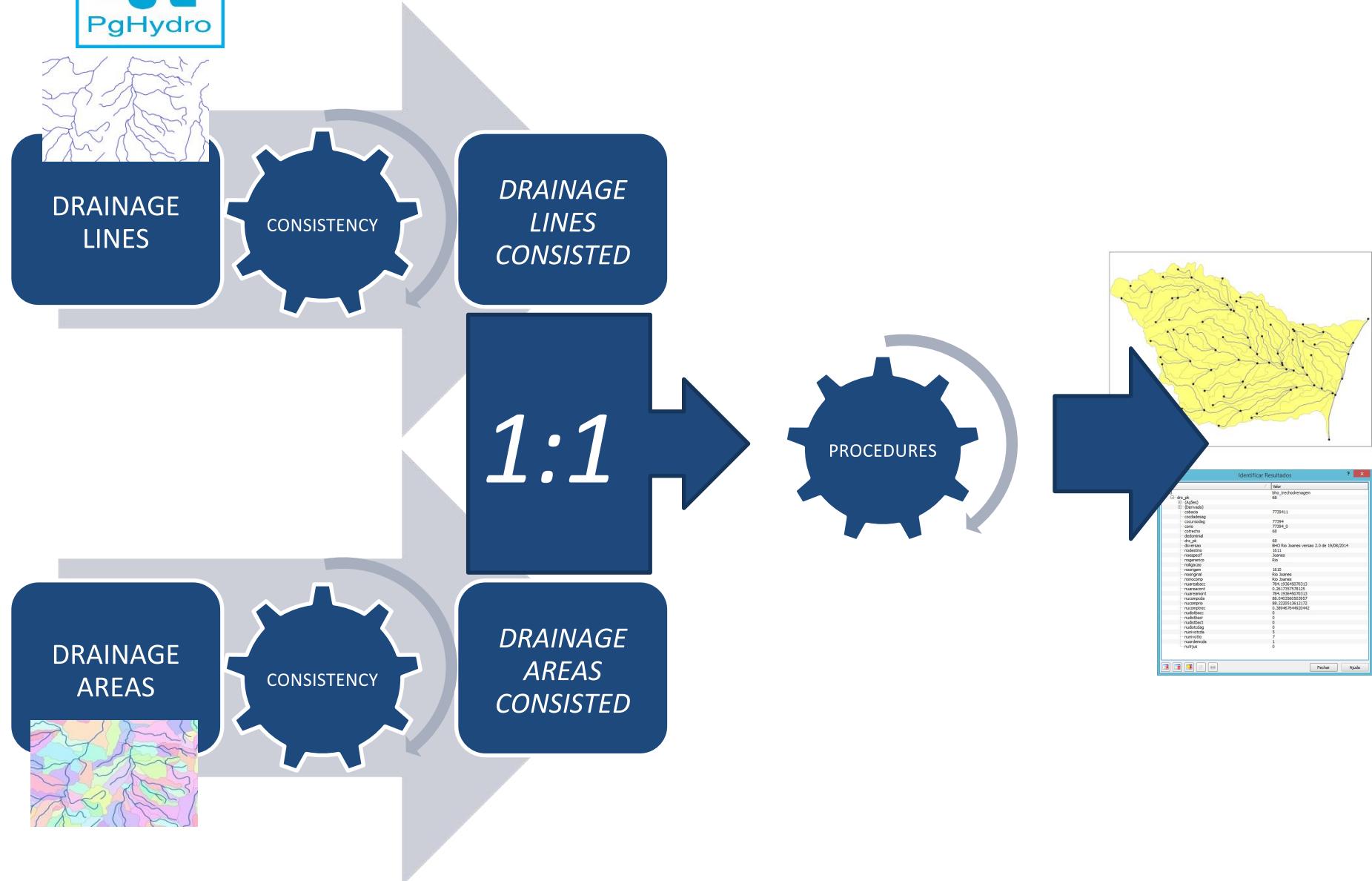
- ▶ Database Extension for PostgreSQL/PostGIS
  - ▶ Schemes
  - ▶ Tables
  - ▶ Queries
  - ▶ Functions
  - ▶ Developed using PLPGSQL



## Main Purpose

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

Otto-codified Hydrographic  
Dataset(OHD)



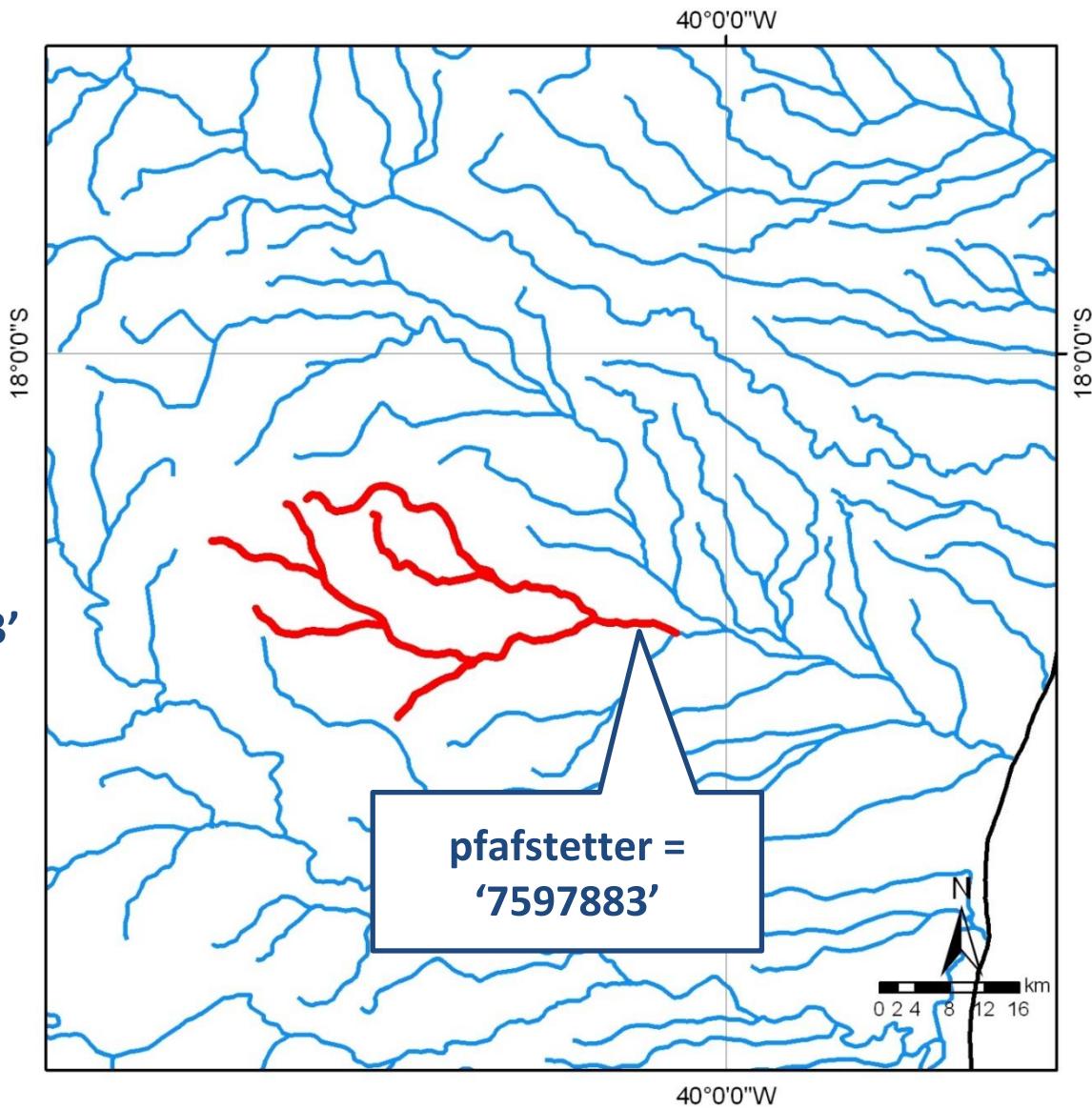


# Otto-codified Hydrographic Dataset (OHD)

- ▶ 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);



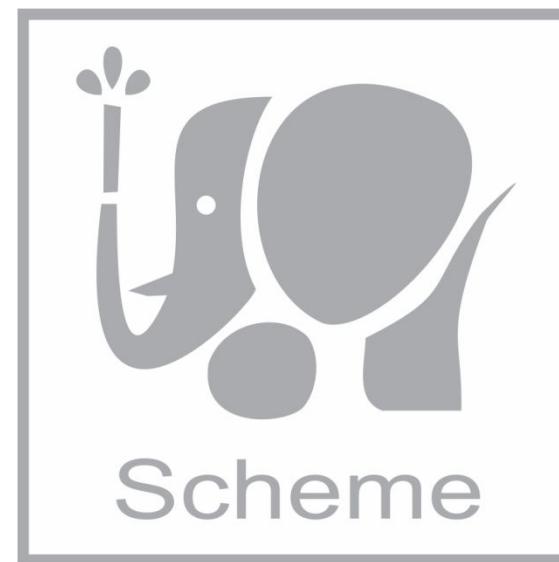
# PgHydro Project

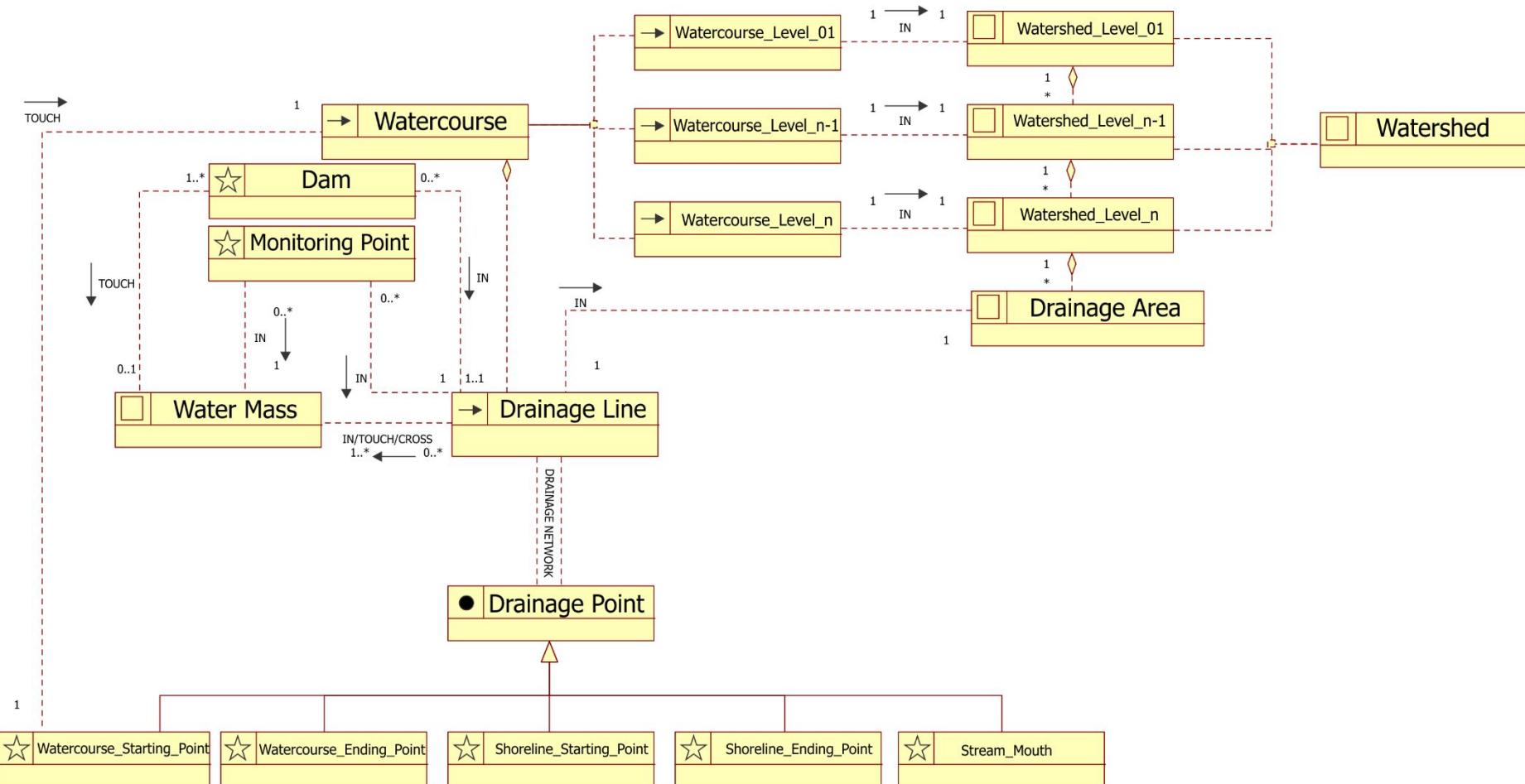




# PgHydro 6.0

## Database Scheme





# Conceptual Model (OMT-G)

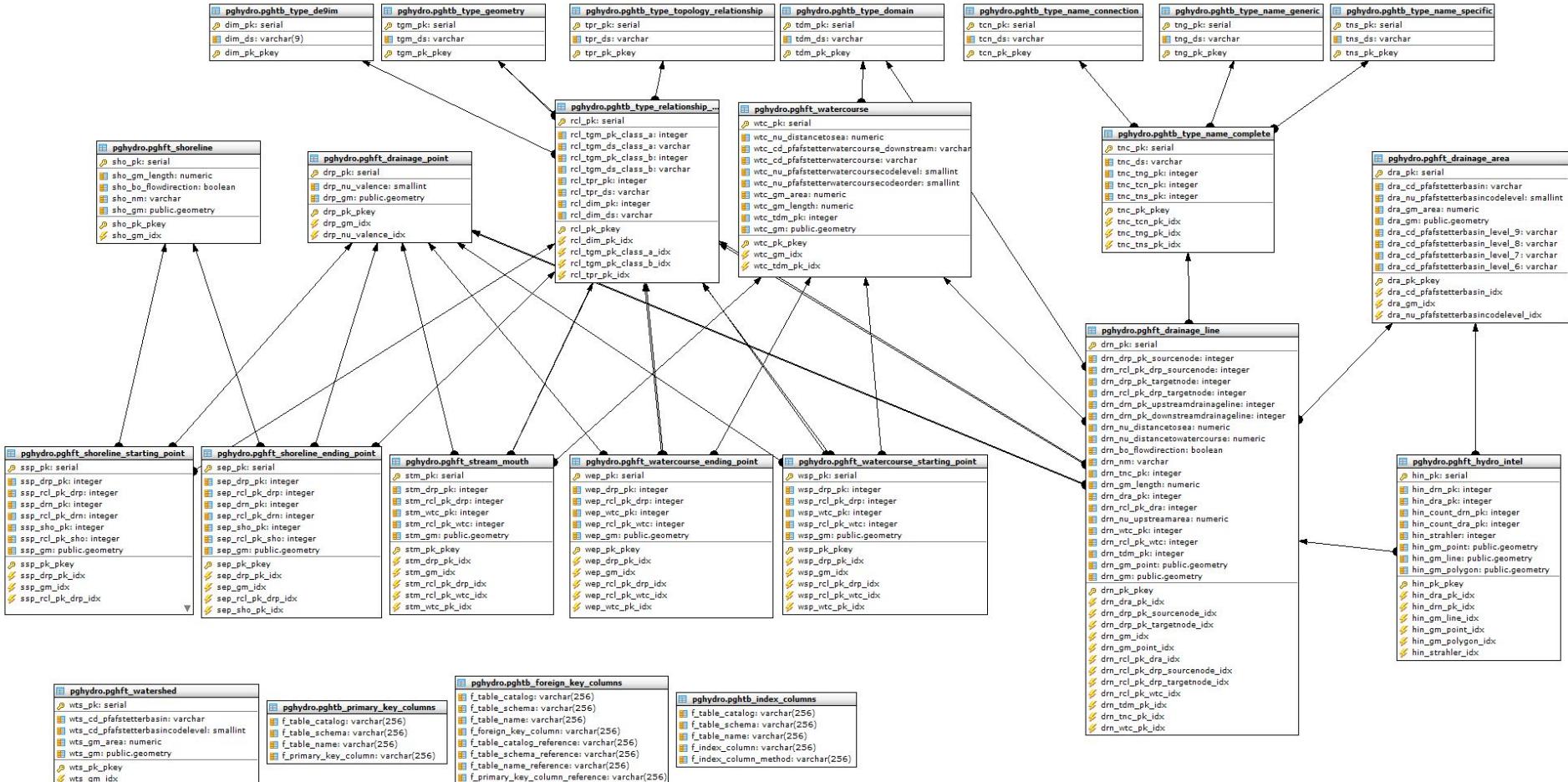


| pghydro.pghft_watercourse  |                 |
|--|-----------------|
| drn_pk   | serial          |
| drn_nu_distancetosea   | numeric         |
| drn_cd_pfafstetterwatercourse_d...<br>drn_cd_pfafstetterwatercourse:<br>drn_cd_pfafstetterwatercoursecod...<br>drn_cd_pfafstetterwatercoursecod... | varchar         |
| drn_nu_pfafstetterwatercoursecod...<br>drn_nu_pfafstetterwatercoursecod...   | integer         |
| drn_gm_area  | numeric         |
| drn_gm_length  | numeric         |
| drn_tdm_pk   | integer         |
| drn_gm   | public.geometry |
| drn_pk_pkey  |                 |
| drn_gm_idx   |                 |
| drn_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...   | integer         |
| drn_drn_pk_downstreamdrainageline... | integer         |
| drn_nu_distancetosea                 | numeric         |
| drn_nu_distancetowatercourse         | num...          |
| 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





# 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;



# pghydro

Water  
Quality

Water  
Mass

Consis-  
tency

output

Water  
Availabi-  
lity

Moni-t  
oring  
Points

 Add PostGIS Table(s) ? X

**Connections**

amazon

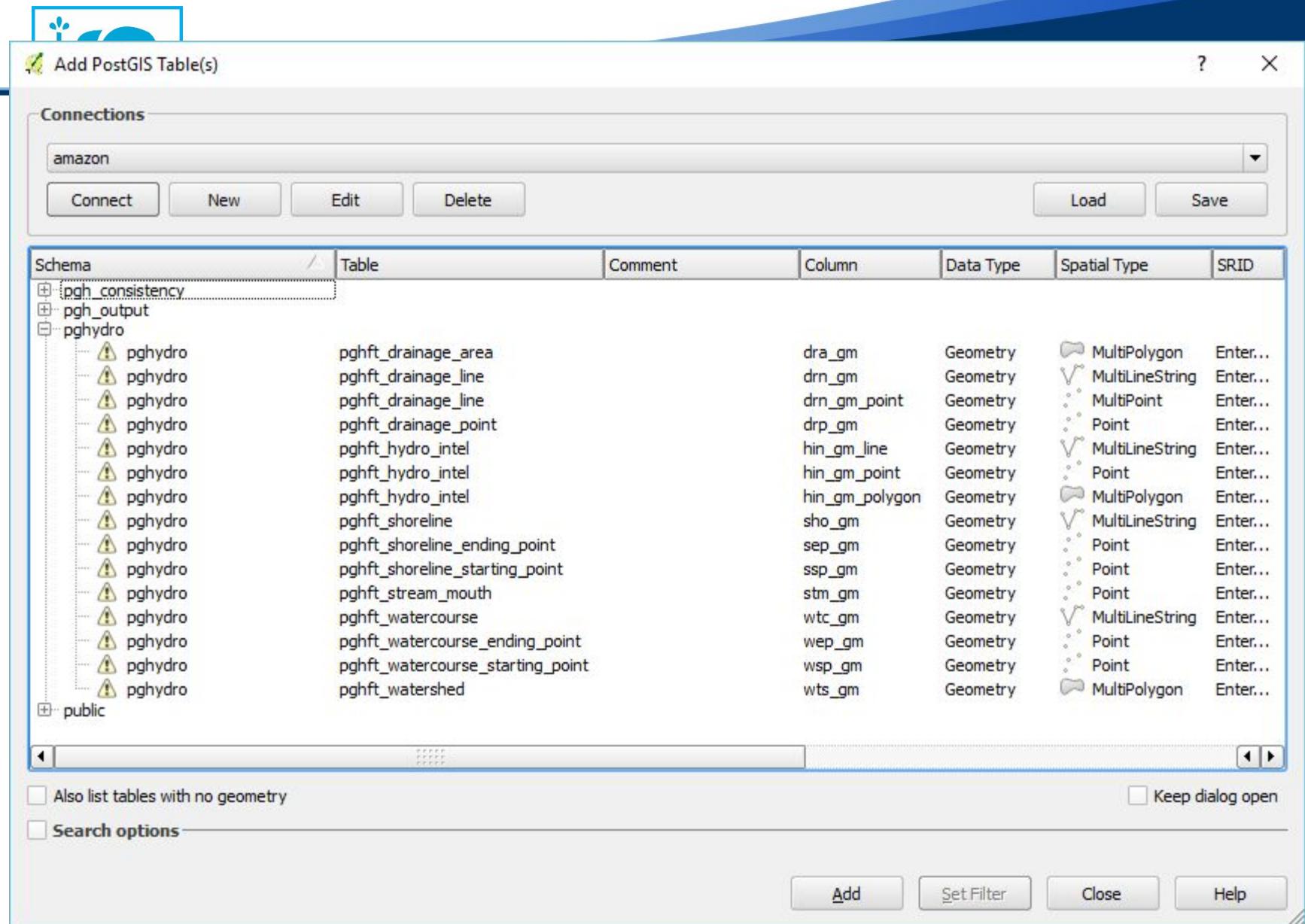
Connect New Edit Delete Load Save

| Schema           | Table | Comment | Column | Data Type | Spatial Type | SRID |
|------------------|-------|---------|--------|-----------|--------------|------|
| pg_h_consistency |       |         |        |           |              |      |
| pg_h_output      |       |         |        |           |              |      |
| pghydro          |       |         |        |           |              |      |
| public           |       |         |        |           |              |      |

Also list tables with no geometry  Keep dialog open

**Search options**

Add Set Filter Close Help





## Object browser

- ▶ pg\_hydro\_main\_watercourse\_confluences(integer)
  - ▶ pg\_hydro\_main\_watercourse\_confluences(integer, integer)
  - ▶ pg\_hydro\_main\_watercourse\_drainagelines(integer)
  - ▶ pg\_hydro\_main\_watercourse\_drainagelines(integer, integer)
  - ▶ pg\_hydro\_numdownstreamdrainagelines(integer)
  - ▶ pg\_hydro\_numpfafstetterbasincodelevel()
  - ▶ pg\_hydro\_numupstreamdrainagelines(integer)
  - ▶ pg\_hydro\_pfafstetter\_codeification(integer, integer)
  - ▶ pg\_hydro\_pfafstetter\_codeifications(integer, integer)
  - ▶ pg\_hydro\_pfafstetterbasincodelevel()
  - ▶ pg\_hydro\_pfafstetterbasincodeleveln(integer)
  - ▶ pg\_hydro\_reversedrainageline()
  - ▶ pg\_hydro\_turnoffkeysindex()
  - ▶ pg\_hydro\_turnonkeysindex()
  - ▶ pg\_hydro\_updatedomaincolumn()
  - ▶ pg\_hydro\_updategeometryrid()
  - ▶ pg\_hydro\_updatepfafstetterbasincode(character varying)
  - ▶ pg\_hydro\_updatepfafstetterwatercoursecode()
  - ▶ pg\_hydro\_updateshoreline()
  - ▶ pg\_hydro\_updateshorelineendingpoint(integer)
  - ▶ pg\_hydro\_updateshorelinestartingpoint(integer)
  - ▶ pg\_hydro\_updatestream\_mouth()
  - ▶ pg\_hydro\_updatewatercourse()
  - ▶ pg\_hydro\_updatewatercourse\_endng\_point()
  - ▶ pg\_hydro\_updatewatercourse\_startng\_point()
  - ▶ pg\_hydro\_updatewatershed(integer)
  - ▶ pg\_hydro\_updatewatersheddrainagearea(integer)
  - ▶ pg\_hydro\_upstreamdrainageline(integer)
  - ▶ pg\_hydro\_upstreamdrainagelines(integer)
  - ▶ pg\_hydro\_upstreamdrainagelines(integer, integer)
  - ▶ pg\_hydro\_upstreamdrainagelinesarea(integer)
  - ▶ pg\_hydro\_upstreamdrainagelinesn(integer, integer)
  - ▶ pg\_hydro\_valence(integer)
  - ▶ pg\_hydro\_variabletosea(integer, character varying, character varying)
  - ▶ pg\_hydro\_variableupstream(integer, character varying, character varying)
- ▶ Sequences (21)
  - ▶ Tables (24)
  - ▶ Trigger Functions (0)
  - ▶ Views (0)

| 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.
```



pgAdmin III

- □ ×

File Edit Plugins View Tools Help



Object browser

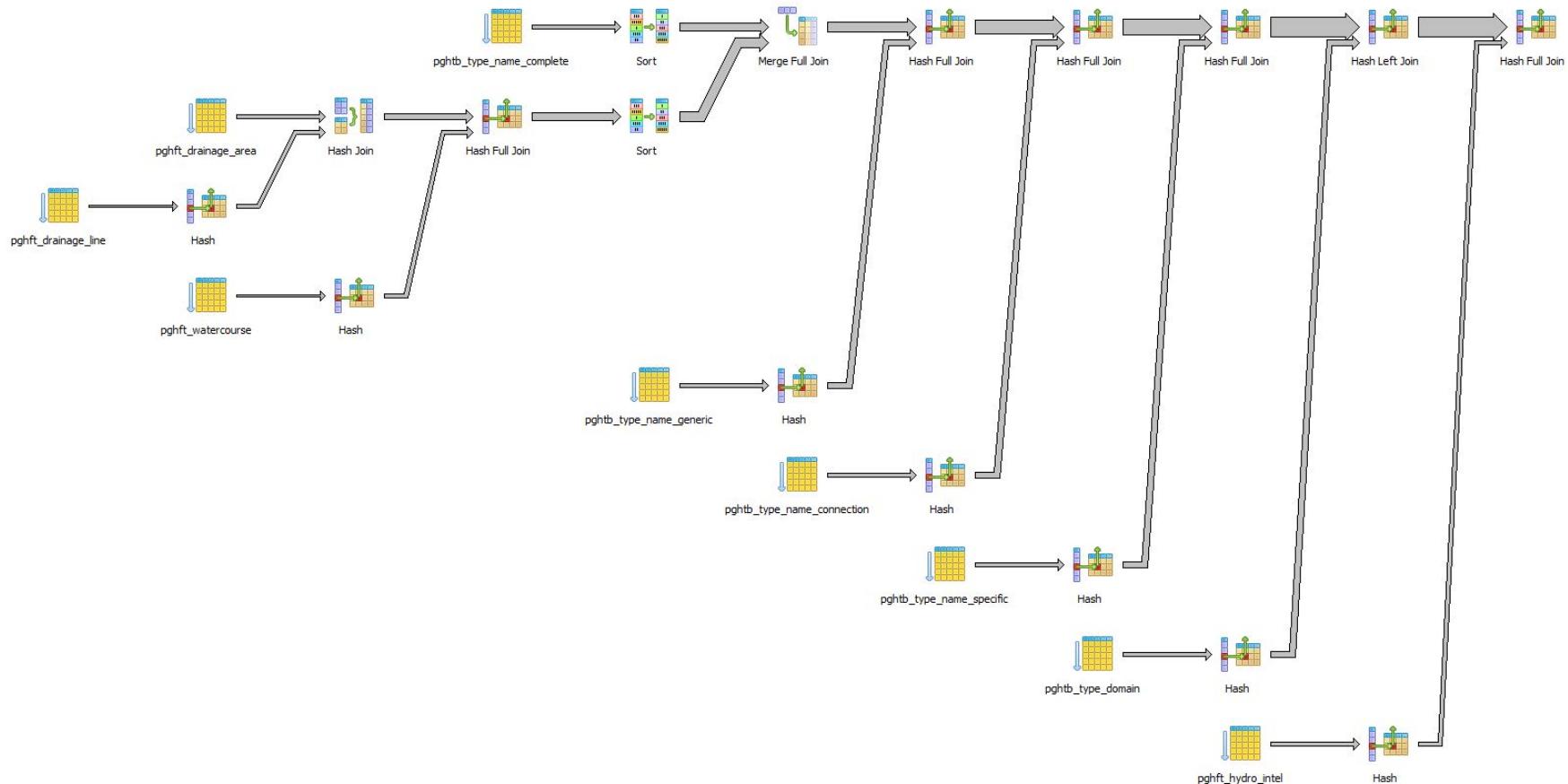
- amazon
  - Catalogs (2)
  - Event Triggers (0)
  - Extensions (5)
  - Schemas (4)
    - pgh\_consistency
    - pgh\_output
      - Collations (0)
      - Domains (0)
      - FTS Configurations (0)
      - FTS Dictionaries (0)
      - FTS Parsers (0)
      - FTS Templates (0)
      - Functions (1)
      - 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: pg_h_output.geoft_bho_trecho_drenagem
-- DROP TABLE pg_h_output.geoft_bho_trecho_drenagem;

CREATE TABLE pg_h_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,
    noligacao character varying,
    noespecif character varying,
    noriocomp character varying,
    nooriginal character varying,
    cocdadesag character varying,
    nutrjus integer,
    nudistbacc numeric,
    nuareabacc numeric,
    nuordemcda smallint,
    nuocompcda numeric,
    nunivotto smallint,
    nunivotcda smallint,
    nustrahler integer
)
```

Retrieving details on table geoft\_bho\_trecho\_drenagem... Done.

0.04 secs



Query - amazon on postgres@localhost:5433 \*

File Edit Query Favourites Macros View Help

SQL Editor Graphical Query Builder

Previous queries Delete Delete All

```
--INPUT DATA
=====
SELECT pg_hydro.pghfn_input_data_drainage_line('public', 'input_drainage_line', 'geom', 'nome');

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

--'nome' - column name;

--IF there is no column name: SELECT pg_hydro.pghfn_input_data_drainage_line('public', 'input_drainage_line', 'geom', 'geom');

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

--Check_DrainageLineGeometryConsistencies

DROP INDEX IF EXISTS pg_hydro.drn_gm_idx;

ALTER TABLE pg_hydro.pghft_drainage_line DROP CONSTRAINT IF EXISTS drn_pk_pkey;

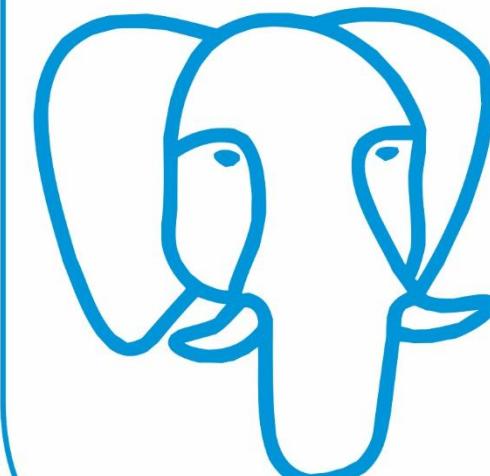
SELECT pg_h_consistency.pghfn_MakeSnapToGridDrainageLine(0.0000001);

SELECT pg_h_consistency.pghfn_removereapetedpointsdrainageline();
```

Output pane

Data Output Explain Messages History

ready DOS Ln 814, Col 40, Ch 26731



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

Conektar

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

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

3.1 - Consistência Geométrica

PRECISÃO: 0.0000001

Verificar Tudo

Geometria Não Simples

Geometria Não Válida

Geometria Não Única

OFFSET(drn\_pk): 1

3.2 - Consistência Topológica

Verificar Tudo

Geometria Dentro de Geometria

Excluir

Geometria Sobrepõe Geometria

Correção Manual

Geometria Com Loop

Correção Manual

3.3 - Consistência Topológica

Verificar Tudo

Geometria Cruza Geometria

Geometria Toca Geometria

Quebrar

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

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  Ligar Índices, PKs e FKs  
 Atualizar Área da Bacia Hidrográfica SRID: 29100 Fator: 1000000  Atualizar Dominialidade (opcional)  
 Calcular Distância à Foz da Bacia: 0  Atualizar Agregação de Bacias  
 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)

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!

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

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!

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

## 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)

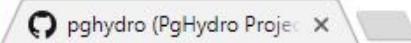
## Main Characteristics

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

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Stars 0

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Following 0

## Popular repositories

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[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

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Learn how we count contributions.

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pghydro/pghydro PgHydro

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

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

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  |

Alexandre

← → C GitHub, Inc. [US] | <https://github.com/pghydro/pghydro>

Apps Favoritos

# 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 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/0B2u6WhefYxhZNTIyMXdFaFhqOVk?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 pg_h_output"
```

**Notes**

Alexandre

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

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Edit

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82 commits 2 branches 2 releases 1 contributor

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| help              | Add files via upload | 15 days ago |
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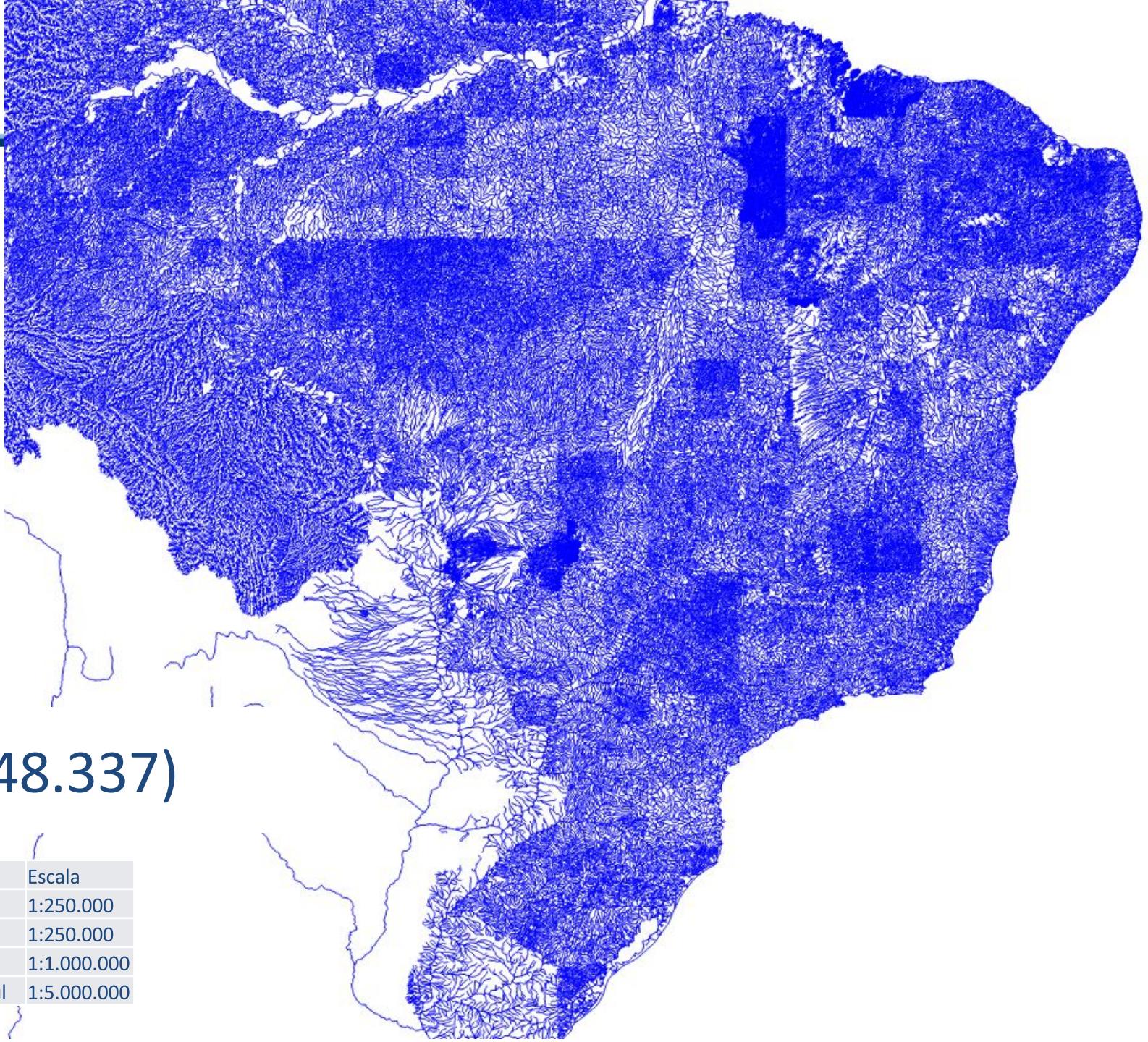
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PgHydro Tools Interface for PgHydro Extension for PostgreSQL/PostGIS

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.  |

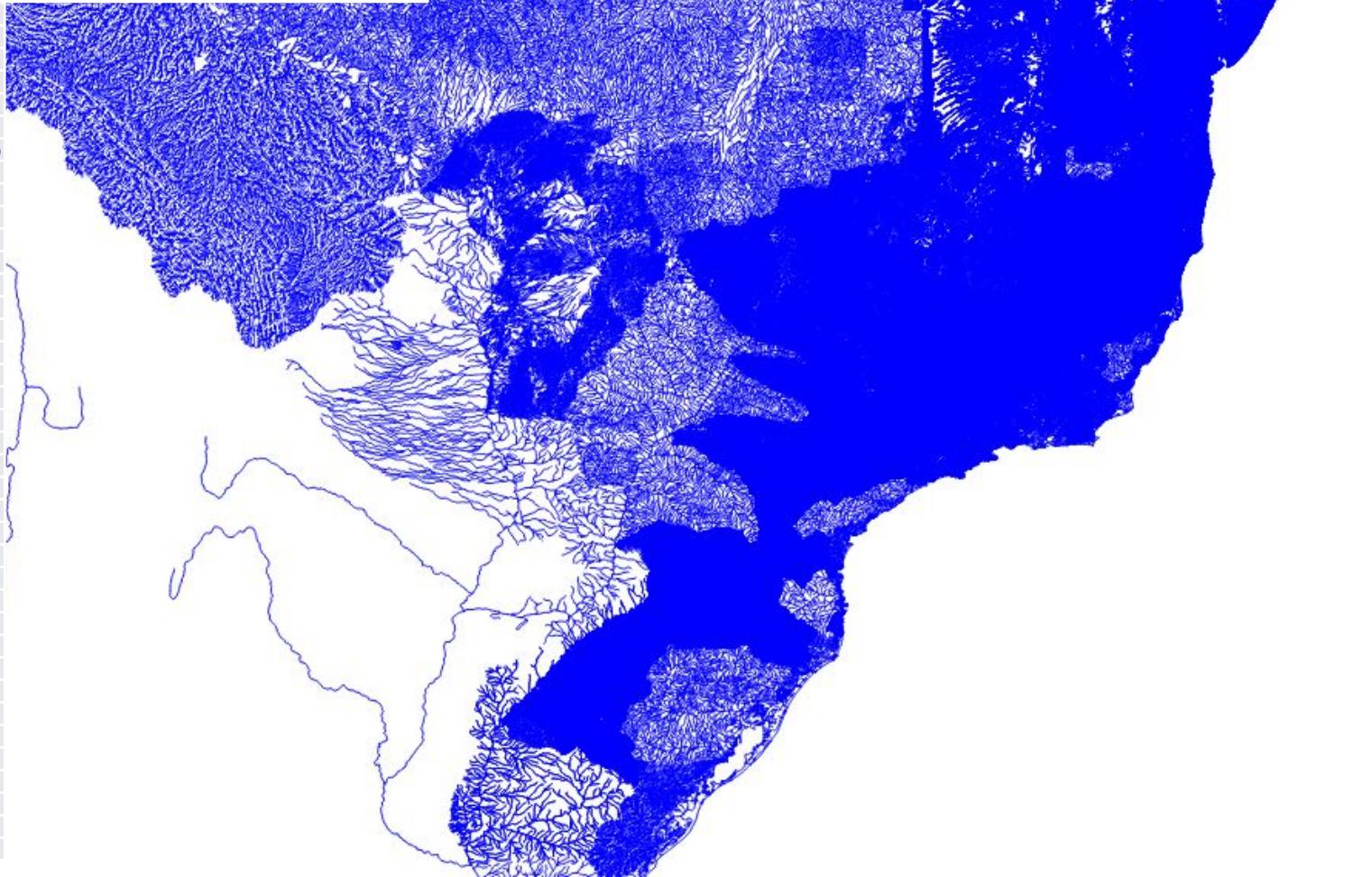


**2008 (248.337)**

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|-------------------------|-------------|
| 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          |
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| 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           |
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| Bacia do Rio Paraguai      | 1:250.000          |
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| 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          |
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| Bacia do Rio Vaza-Barris   | 1:100.000          |
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# Thank You!

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