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# **pyswmm Documentation**

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# Contents

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<b>1</b>	<b>Overview</b>	<b>1</b>
1.1	Who uses PySWMM? . . . . .	1
1.2	Goals . . . . .	1
1.3	Powered By . . . . .	2
1.4	Free software . . . . .	2
<b>2</b>	<b>Download</b>	<b>3</b>
2.1	Software . . . . .	3
<b>3</b>	<b>Authors</b>	<b>5</b>
3.1	Maintainers . . . . .	5
3.2	Authors with Copyrighted Contributions . . . . .	5
3.3	Authors with Contributions in the Public Domain . . . . .	5
<b>4</b>	<b>Installing</b>	<b>7</b>
4.1	Installing with pip . . . . .	7
4.2	Requirements . . . . .	7
<b>5</b>	<b>Tutorial</b>	<b>9</b>
5.1	Loading a Model . . . . .	9
5.2	Nodes . . . . .	10
5.3	Links . . . . .	10
5.4	Subcatchments . . . . .	11
5.5	PySWMM Controls . . . . .	11
5.6	Generate Node Inflows . . . . .	12
5.7	Lid Controls . . . . .	12
5.8	Lid Groups . . . . .	12
5.9	Lid Units . . . . .	13
<b>6</b>	<b>Reference</b>	<b>15</b>
6.1	Introduction . . . . .	15
6.2	simulation module . . . . .	15
6.3	nodes module . . . . .	22
6.4	links module . . . . .	32
6.5	lidcontrols module . . . . .	43
6.6	lidgroups module . . . . .	44
6.7	lidlayers module . . . . .	47

6.8	lidunits module . . . . .	51
6.9	raingages module . . . . .	55
6.10	subcatchments module . . . . .	57
6.11	system module . . . . .	65
6.12	lib module . . . . .	66
6.13	License . . . . .	67
<b>7</b>	<b>Powered By</b>	<b>69</b>
<b>8</b>	<b>Indices and tables</b>	<b>71</b>
	<b>Python Module Index</b>	<b>73</b>
	<b>Index</b>	<b>75</b>

PySWMM is a Python language software package for the creation, manipulation, and study of the structure, dynamics, and function of complex networks.

With PySWMM you can load and manipulate USEPA Stormwater Management Models. With the development of PySWMM, control algorithms can now be developed exclusively in Python which allows the use of functions and objects as well as storing and tracking hydraulic trends for control actions.

### 1.1 Who uses PySWMM?

PySWMM is used by engineers, modelers, and researchers who want to streamline stormwater modeling optimization, controls, and post-processing results.

### 1.2 Goals

PySWMM is intended to provide

- tools for the study of the structure and dynamics within USEPA SWMM5,
- a standard programming interface and graph implementation that is suitable for many applications,
- a rapid development environment for collaborative, multidisciplinary projects,
- an interface to USEPA SWMM5,
- development and implementation of control logic outside of native EPA-SWMM Controls,
- methods for users to establish their own node inflows,
- a coding interface to binary output files,
- new modeling possibilities for the SWMM5 Community.

## 1.3 Powered By



## 1.4 Free software

PySWMM is free software; you can redistribute it and/or modify it under the terms of the *BSD License*. We welcome contributions from the community. Information on PySWMM development is found at the PySWMM Github Page <https://github.com/OpenWaterAnalytics/pyswmm>

### 1.4.1 What Next

- *A Brief Tour*
- *Installing*
- *Reference*
- *Examples*

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Download

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### 2.1 Software

Source and binary releases: <http://pypi.python.org/pypi/pyswmm/>

Github (latest development): <https://github.com/OpenWaterAnalytics/pyswmm>





### 3.1 Maintainers

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- Katherine Ratliff
- Jennifer Wu

### 3.2 Authors with Copyrighted Contributions

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- Stephen Roberts
- Abhiram Mullapudi
- Jiada Li

### 3.3 Authors with Contributions in the Public Domain

- Michael Tryby



### 4.1 Installing with pip

Try to install it with

```
pip install pyswmm
```

and an attempt will be made to find and install an appropriate version that matches your operating system and Python version.

You can also get pyswmm from the Python Package Index manually at <http://pypi.python.org/pypi/pyswmm> To use pip, you need to have [setuptools](#) installed.

### 4.2 Requirements

#### 4.2.1 Python

To use PySWMM you need Python 3.6 or greater.



Start here to begin working with pyswmm.

The pyswmm package allows seamless interaction with the USEPA-SWMM5 data model. Parameter getters/setters and results getters have been exposed, allowing the user to see results while a simulation is running as well as update link settings.

## 5.1 Loading a Model

There are three options to load a model. If there is no desire to interact with the simulation then the simplest way to run the model is the following:

```
>>> from pyswmm import Simulation
>>>
>>> sim = Simulation('./testmodel.inp')
>>> sim.execute()
```

The following method allows the user to read in a model and manually step through the simulation and get/set parameters and results. This scenario is the cleanest solution using a with statement. It automatically cleans up after the simulation is complete.

```
>>> from pyswmm import Simulation
>>>
>>> with Simulation('./testmodel.inp') as sim:
...     for step in sim:
...         pass
```

One feature that pyswmm adds to the modeling world is the simulation stride function `step_advance`. Assuming a user has developed all of their control rules in a Python script, to reduce simulation time a user can specify how often Python controls should be evaluated.

For example, let's assume `testmodel.inp` has a 30 second routing step (using the dynamic wave solver, this step could vary significantly). If complex control scenarios are developed, evaluating rules could add significant time to the simulation.

```
>>> from pyswmm import Simulation
>>>
>>> with Simulation('testmodel.inp') as sim:
...     sim.step_advance(300)
...     for step in sim:
...         print(sim.current_time)
...         # or here! sim.step_advance(newvalue)

2015-11-01 14:05:00
2015-11-01 14:10:00
2015-11-01 14:15:00
2015-11-01 14:20:00
```

## 5.2 Nodes

For interacting with nodes a `pyswmm.nodes.Nodes` object must be initialized. See the following example. Once the Nodes object is initialized, you can then initialize a `pyswmm.nodes.Node`

```
>>> from pyswmm import Simulation, Nodes
>>>
>>> with Simulation('./testmodel.inp') as sim:
...     node_object = Nodes(sim)
...
...     #J1 node instantiation
...     J1 = node_object["J1"]
...     print(J1.invert_elevation)
...     print(J1.is_junction())
...
...     #Step through a simulation
...     for step in sim:
...         print(J1.total_inflow)
...
... 
```

## 5.3 Links

For interacting with links a `pyswmm.links.Links` object must be initialized. See the following example. Once the Links object is initialized, you can then initialize a `pyswmm.links.Link`

```
>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('./testmodel.inp') as sim:
...     link_object = Links(sim)
...
...     #C1:C2 link instantiation
...     clc2 = link_object["C1:C2"]
...     print(clc2.flow_limit)
...     print(clc2.is_conduit())
...
...     #Step through a simulation
...     for step in sim:
...         print(clc2.flow)
...         if clc2.flow > 10.0:
```

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```
...         clc2.target_setting = 0.5
... 
```

## 5.4 Subcatchments

For interacting with subcatchments a `pyswmm.subcatchments.Subcatchments` object must be initialized. See the following example. Once the Subcatchments object is initialized, you can then initialize a `pyswmm.subcatchments.Subcatchment`

```
>>> from pyswmm import Simulation, Subcatchments
>>>
>>> with Simulation('./testmodel.inp') as sim:
...     subcatch_object = Subcatchments(sim)
...
...     #SC1 subcatchment instantiation
...     SC1 = subcatch_object["S1"]
...     print(SC1.area)
...
...     #Step through a simulation
...     for step in sim:
...         print(SC1.runoff)
... 
```

In the example above we introduce the option to change a link's settings.

## 5.5 PySWMM Controls

The pyswmm package exposes new possibility in interfacing with models. All control rules can now be removed from USEPA SWMM5 and brought into Python. Now that this functionality exists, open-source Python packages can now be used in conjunction with pyswmm to bring even more complex control routines.

The following example illustrates the use of functions for comparing two depths.

```
>>> from pyswmm import Simulation, Links, Nodes
>>>
>>> def TestDepth(node, node2):
>>>     if node > node2:
>>>         return True
>>>     else:
>>>         return False
>>>
>>> with Simulation('./testmodel.inp') as sim:
...     link_object = Links(sim)
...
...     #C1:C2 link instantiation
...     clc2 = link_object["C1:C2"]
...
...     node_object = Nodes(sim)
...     #J1 node instantiation
...     J1 = node_object["J1"]
...     #J2 node instantiation
...     J2 = node_object["J2"]
```

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```

...
...     #Step through a simulation
...     for step in sim:
...         if TestDepth(J1.depth, J2.depth):
...             clc2.target_setting = 0.5
...

```

If an EPA-SWMM5 Model has existing control actions within, any control rules developed using pyswmm will have the highest priority. All pyswmm control actions are evaluated at the end of each simulation step, after EPA-SWMM native controls have been evaluated. If control actions are reported, any control action updated by pyswmm will be output to the \*.rpt file.

## 5.6 Generate Node Inflows

Among the newest features pyswmm brings to SWMM5 modeling is the ability to set a nodes inflow. This can enable the user to model different behavior such as runoff or seasonality.

```

>>> from pyswmm import Simulation, Nodes
>>>
>>> with Simulation('/testmodel.inp') as sim:
...     j1 = Nodes(sim) ["J1"]
...     for step in sim:
...         j1.generated_inflow(9)

```

## 5.7 Lid Controls

For interacting with lid controls a `pyswmm.lidcontrols.LidControls` object must be initialized. See the following example. Once the `LidControls` object is initialized, you can then initialize a `pyswmm.lidcontrols.LidControl`. Once the `LidControl` object is initialized, you can then interact with the parameters defined in each layers within an Lid Control: Surface, Soil, Storage, Pavement, Drain, DrainMat.

The layers parameters that can be accessed using PySWMM are listed in the table below.

```

>>> from pyswmm import Simulation, LidControls
>>>
>>> with Simulation('/testmodel.inp') as sim:
...     rain_barrel = LidControls(sim) ["rain_barrel"]
...     print(rain_barrel.drain.coefficient)
...     rain_barrel.drain.coefficient = 0.60
...     print(rain_barrel.drain.coefficient)

```

All `LidControl` parameters can be accessed before and during model simulations. All `LidControl` parameters can be set before model simulation. Only some `LidControl` parameters can be set during model simulation.

## 5.8 Lid Groups

For interacting with group of lids defined on a subcatchment `pyswmm.lidgroups.LidGroups` object must be initialized. See the following example. Once the `LidGroups` object is initialized, you can then initialize a `pyswmm.lidgroups.LidGroup`. Once the `LidGroup` object is initialized, you can then interact with the lid units defined on the subcatchment. You can iterate through the list of lid units using the `LidGroup` object.



```

>>> from pyswmm import Simulation, LidGroups
>>>
>>> with Simulation('/testmodel.inp') as sim:
...     lid_on_sub = LidGroups(sim) ["subcatch_id"]
...     for lid in lid_on_sub:
...         print(lid)
...     print(lid_on_sub[0])
...     for step in sim:
...         print(lid_on_sub.old_drain_flow)

```

## 5.9 Lid Units

For interacting with group of lids defined on a subcatchment `pyswmm.lidgroups.LidGroups` object must be initialized. See the example above. Once the `LidGroups` object is initialized, you can then initialize a `pyswmm.lidgroups.LidGroup`. Once the `LidGroup` object is initialized, you can then interact with the lid units defined on the subcatchment. You can iterate through the list of lid units using the `LidGroup` object.

```

>>> from pyswmm import Simulation, LidGroups
>>>
>>> with Simulation('/testmodel.inp') as sim:
...     lid_on_sub = LidGroups(sim) ["subcatch_id"]
...     for lid in lid_on_sub:
...         print(lid)
...     print(lid_on_sub[0])
...     for step in sim:
...         print(lid_on_sub.WaterBalance.inflow)
...         print(lid_on_sub.WaterBalance.evaporation)

```

All `LidUnits` parameters can be accessed before and during model simulations. All `LidUnits` parameters can be set before model simulation. Only some `LidUnits` parameters can be set during model simulation.

### What Next

Now that you have an idea of what the PySWMM package provides, you should investigate the parts of the package most useful for you.

*Reference Section* provides details on PySWMM.



## 6.1 Introduction

### 6.1.1 PySWMM Basics

After starting Python, import the pyswmm module with

```
>>> from pyswmm import Simulation
```

To save repetition, in the documentation we assume that PySWMM has been imported this way.

If importing pyswmm fails, it means that Python cannot find the installed module. Check your installation and your PYTHONPATH.

The following simulation classes are available:

**Simulation** This class initializes a simulation object from a SWMM input file (\*.inp).

Initialize a SWMM Model with

```
>>> sim = Simulation(r"./example.inp")
```

Once a model is initialized, there are several options available to run a simulation as well as edit the simulation.

## 6.2 simulation module

Base class for a SWMM Simulation.

```
class pyswmm.simulation.Simulation(inputfile, reportfile=None, outputfile=None,  
                                   swmm_lib_path=None)
```

Bases: `object`

Base class for a SWMM Simulation.

The model object provides several options to run a simulation. User can specified SWMM library path. Uses default lib if not provided.

Initialize the Simulation class.

#### Parameters

- **infile** (*str*) – Name of SWMM input file (default '')
- **rptfile** (*str*) – Report file to generate (default None)
- **binfile** (*str*) – Optional binary output file (default None)
- **swmm\_lib\_path** (*str*) – User-specified SWMM library path (default None).

Examples:

Intialize a simulation and iterate through a simulation. This approach requires some clean up.

```
>>> from pyswmm import Simulation
>>>
>>> sim = Simulation('tests/data/TestModell_weirSetting.inp')
>>> for step in sim:
...     pass
>>>
>>> sim.report()
>>> sim.close()
```

Intialize using with statement. This automatically cleans up after a simulation

```
>>> from pyswmm import Simulation
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     for step in sim:
...         pass
...     sim.report()
```

Initialize the simulation and execute. This style does not allow the user to interact with the simulation. However, this approach tends to be the fastest.

```
>>> from pyswmm import Simulation
>>>
>>> sim = Simulation('tests/data/TestModell_weirSetting.inp')
>>> sim.execute()
```

#### **add\_after\_close** (*callback*)

Add callback function/method/object to execute after the simulation is closed. Needs to be callable.

**Parameters** **callback** (*func*) – Callable Object

(See self.add\_before\_start() for more details)

#### **add\_after\_end** (*callback*)

Add callback function/method/object to execute after the simulation ends. Needs to be callable.

**Parameters** **callback** (*func*) – Callable Object

(See self.add\_before\_start() for more details)

#### **add\_after\_step** (*callback*)

Add callback function/method/object to execute after a simulation step. Needs to be callable.

**Parameters** **callback** (*func*) – Callable Object

(See `self.add_before_start()` for more details)

**add\_before\_end** (*callback*)

Add callback function/method/object to execute after the simulation ends. Needs to be callable.

**Parameters** **callback** (*func*) – Callable Object

(See `self.add_before_start()` for more details)

**add\_before\_start** (*callback*)

Add callback function/method/object to execute before the simulation starts. Needs to be callable.

**Parameters** **callback** (*func*) – Callable Object

```
>>> from pyswmm import Simulation
>>>
>>> def test_callback():
...     print("CALLBACK - Executed")
>>>
>>> with Simulation('./TestModell_weirSetting.inp') as sim:
...
...     sim.before_start(test_callback) #<- pass function handle.
...     print("Waiting to Start")
...     for ind, step in enumerate(sim):
...         print("Step {}".format(ind))
...     print("Complete!")
... print("Closed")
>>>
>>> "Waiting to Start"
>>> "CALLBACK - Executed"
>>> "Step 0"
>>> "Step 1"
>>> ...
>>> "Complete!"
>>> "Closed"
```

**add\_before\_step** (*callback*)

Add callback function/method/object to execute before a simulation step. Needs to be callable.

**Parameters** **callback** (*func*) – Callable Object

(See `self.add_before_start()` for more details)

**after\_close** ()

Get After Close Callback.

**Returns** Callbacks

**after\_end** ()

Get After End Callback.

**Returns** Callbacks

**after\_step** ()

Get After Step Callback.

**Returns** Callbacks

**before\_end** ()

Get Before End Callback.

**Returns** Callbacks

**before\_start()**  
Get Before Start Callback.  
**Returns** Callbacks

**before\_step()**  
Get Before Step Callback.  
**Returns** Callbacks

**close()**  
Intialize a simulation and iterate through a simulation. This approach requires some clean up.

Examples:

```
>>> from pyswmm import Simulation
>>>
>>> sim = Simulation('./TestModell_weirSetting.inp')
>>> for step in sim:
...     pass
>>>
>>> sim.report()
>>> sim.close()
```

**current\_time**  
Get Simulation Current Time.  
**Returns** Current Simulation Time  
**Return type** Datetime

Examples:

```
>>> from pyswmm import Simulation
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     for step in sim:
...         print(sim.current_time)
...         sim.report()
>>>
>>> 2015-11-01 14:00:30
>>> 2015-11-01 14:01:00
>>> 2015-11-01 14:01:30
>>> 2015-11-01 14:02:00
```

**end\_time**  
Get/set Simulation end time.

Examples:

```
>>> from pyswmm import Simulation
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     print sim.end_time
...     sim.end_time = datetime(2016, 5, 10, 15, 15, 1)
>>>
>>> datetime.datetime(2016, 5, 10, 15, 15, 1)
```

**engine\_version**  
Retrieves the SWMM Engine Version.  
**Returns** Engine Version

**Return type** StrictVersion

Examples:

```
>>> sim = PYSWMM(r'\test.inp')
>>> sim.engine_version
StrictVersion("5.1.13")
```

**execute ()**

Open an input file, run SWMM, then close the file.

Examples:

```
>>> sim = PYSWMM(r'\test.inp')
>>> sim.execute()
```

**flow\_routing\_error**

Retrieves the Flow Routing Mass Balance Error.

**Returns** Flow Routing Mass Balance Error**Return type** float

Examples:

```
>>> sim = PYSWMM(r'\test.inp')
>>> sim.execute()
>>> sim.flow_routing_error
0.01
```

**flow\_units**

Get Simulation Units (CFS, GPM, MGD, CMS, LPS, MLD).

**Returns** Flow Unit**Return type** str

Examples:

```
>>> from pyswmm import Simulation
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     print sim.flow_units
>>>
>>> CFS
```

**initial\_conditions** (*init\_conditions*)Initial Conditions for Hydraulics and Hydrology can be set from within the api by setting a function to the `initial_conditions` property.

```
>>> from pyswmm import Simulation
>>>
>>> with Simulation('./TestModell_weirSetting.inp') as sim:
...     nodeJ1 = Nodes(sim) ["J1"]
...
...     def init_conditions():
...         nodeJ1.initial_depth = 4
...
...     sim.initial_conditions(init_conditions)
...
... 
```

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```

...     for step in sim:
...         pass
...     sim.report()

```

**next ()**  
Next

**percent\_complete**  
Get Simulation Percent Complete.

**Returns** Current Percent Complete

**Return type** Datetime

Examples:

```

>>> from pyswmm import Simulation
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     for step in sim:
...         print(sim.percent_complete)
...     sim.report()
>>>
>>> 0.01
>>> 0.25
>>> 0.50
>>> 0.75

```

**quality\_error**  
Retrieves the Quality Routing Mass Balance Error.

**Returns** Quality Routing Mass Balance Error

**Return type** float

Examples:

```

>>> sim = PYSWMM(r'\test.inp')
>>> sim.execute()
>>> sim.quality_error
0.01

```

**report ()**  
Writes to report file after simulation.

Examples:

```

>>> from pyswmm import Simulation
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     for step in sim:
...         pass
...     sim.report()

```

**report\_start**  
Get/set Simulation report start time.

Examples:



```

>>> from pyswmm import Simulation
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     print sim.report_start
...     sim.report_start = datetime(2015,5,10,15,15,1)
>>>
>>> datetime.datetime(2015,5,10,15,15,1)

```

**runoff\_error**

Retrieves the Runoff Mass Balance Error.

**Returns** Runoff Mass Balance Error

**Return type** float

Examples:

```

>>> sim = PYSWMM(r'\test.inp')
>>> sim.execute()
>>> sim.runoff_error
0.01

```

**start ()**

Start Simulation

**start\_time**

Get/set Simulation start time.

Examples:

```

>>> from pyswmm import Simulation
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     print sim.start_time
...     sim.start_time = datetime(2015,5,10,15,15,1)
>>>
>>> datetime.datetime(2015,5,10,15,15,1)

```

**step\_advance** (*advance\_seconds*)

Advances the model by X number of seconds instead of intervening at every routing step. This does not change the routing step for the simulation; only lets python take back control after each advance period.

**Parameters** **advance\_seconds** (*int*) – Seconds to Advance simulation

Examples:

```

>>> from pyswmm import Simulation
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     sim.step_advance(300)
...     for step in sim:
...         print(step.current_time)
...         # or here! sim.step_advance(newvalue)
...     sim.report()
>>>
>>> 2015-11-01 14:00:30
>>> 2015-11-01 14:01:00
>>> 2015-11-01 14:01:30
>>> 2015-11-01 14:02:00

```

**system\_units**

Get system units (US, SI).

**Returns** System Unit**Return type** str

Examples:

```
>>> from pyswmm import Simulation
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     print sim.system_units
>>>
>>> US
```

## 6.3 nodes module

Nodes module for the pythonic interface to SWMM5.

**class** pyswmm.nodes.Nodes (*model*)

Bases: object

Node Iterator Methods.

**Parameters** *model* (*object*) – Open Model Instance

Examples:

```
>>> from pyswmm import Simulation, Nodes
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     for node in Nodes(sim):
...         print node
...         print node.nodeid
...
>>> <swmm5.Node object at 0x031B0350>
>>> J1
>>> <swmm5.Node object at 0x030693D0>
>>> J2
>>> <swmm5.Node object at 0x031B0350>
>>> J3
>>> <swmm5.Node object at 0x030693D0>
>>> J0
```

Iterating over Nodes Object

```
>>> nodes = Nodes(sim)
>>> for node in nodes:
...     print node.nodeid
>>> J0
>>> J1
>>> J2
>>> J3
```

Testing Existence

```
>>> nodes = Nodes(sim)
>>> "J1" in nodes
>>> True
```

### Initializing a node Object

```
>>> nodes = Nodes(sim)
>>> j1 = nodes['J1']
>>> print(j1.invert_elevation)
>>> 12
>>>
>>> j1.invert_elevation = 200
>>> print(j1.invert_elevation)
>>> 200
```

**next ()**

**class** pyswmm.nodes.**Node** (*model, nodeid*)

Bases: `object`

Node Methods.

#### Parameters

- **model** (*object*) – Open Model Instance
- **nodeid** (*str*) – Node ID

Examples:

```
>>> from pyswmm import Simulation, Nodes
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     j1 = Nodes(sim) ["J1"]
...     print j1.invert_el
...     for step in simulation:
...         print j1.depth
...     0.0
```

### depth

Get Node Results for Depth.

If Simulation is not running this method will raise a warning and return 0.

**Returns** Parameter Value

**Return type** `float`

Examples:

```
>>> from pyswmm import Simulation, Nodes
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     j1 = Nodes(sim) ["J1"]
...     for step in sim:
...         print j1.depth
>>> 0
>>> 0.5
>>> 0.51
>>> 0.52
>>> 0.49
```

**flooding**

Get Node Results for Flooding Rate.

If Simulation is not running this method will raise a warning and return 0.

**Returns** Parameter Value

**Return type** float

Examples:

```
>>> from pyswmm import Simulation, Nodes
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     j1 = Nodes(sim) ["J1"]
...     for step in sim:
...         print j1.flooding
>>> 0
>>> 0
>>> 0.01
>>> 0
>>> 0
```

**full\_depth**

Get node full depth (Physical Depth of manhole).

**Returns** Parameter Value

**Return type** float

Examples:

```
>>> from pyswmm import Simulation, Nodes
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     j1 = Nodes(sim) ["J1"]
...     print j1.full_depth
>>> 10
```

Setting the value

```
>>> from pyswmm import Simulation, Nodes
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     j1 = Nodes(sim) ["J1"]
...     print j1.full_depth
...     j1.full_depth = 50
...     print j1.full_depth
>>> 10
>>> 50
```

**generated\_inflow** (*inflowrate*)

Generate and Set a Node Inflow Rate.

The value is held constant in the model until it is redefined. Generated inflows work like any SWMM inflow. This does not introduce any continuity errors since all flows is counted as an inflow.

**Parameters** *inflowrate* (*float*) – Inflow Rate

Examples:

```
>>> from pyswmm import Simulation, Nodes
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     j1 = Nodes(sim) ["J1"]
...     for step in sim:
...         j1.generated_inflow(9)
>>>
```

**head**

Get Node Results for Head.

If Simulation is not running this method will raise a warning and return 0.

**Returns** Parameter Value

**Return type** float

Examples:

```
>>> from pyswmm import Simulation, Nodes
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     j1 = Nodes(sim) ["J1"]
...     for step in sim:
...         print j1.head
>>> 10
>>> 10.5
>>> 10.51
>>> 10.52
>>> 10.49
```

**initial\_depth**

Get/set node initial depth.

**Returns** Parameter Value

**Return type** float

Examples:

```
>>> from pyswmm import Simulation, Nodes
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     j1 = Nodes(sim) ["J1"]
...     print j1.initial_depth
>>> 0
```

Setting the value

```
>>> from pyswmm import Simulation, Nodes
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     j1 = Nodes(sim) ["J1"]
...     print j1.initial_depth
...     j1.initial_depth = 1
...     print j1.initial_depth
>>> 0
>>> 1
```

**invert\_elevation**

Get/set node invert elevation.

**Returns** Parameter Value

**Return type** float

Examples:

```
>>> from pyswmm import Simulation, Nodes
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     j1 = Nodes(sim) ["J1"]
...     print j1.invert_elevation
>>> 0.1
```

Setting the value

```
>>> from pyswmm import Simulation, Nodes
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     j1 = Nodes(sim) ["J1"]
...     print j1.invert_elevation
...     j1.invert_elevation = 0.2
...     print j1.invert_elevation
>>> 0.1
>>> 0.2
```

**is\_divider()**

Check if node is a Divider Type.

**Returns** is divider

**Return type** bool

Examples:

```
>>> from pyswmm import Simulation, Nodes
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     j1 = Nodes(sim) ["J1"]
...     print j1.is_divider()
>>> True
```

**is\_junction()**

Check if node is a Junction Type.

**Returns** is junction

**Return type** bool

Examples:

```
>>> from pyswmm import Simulation, Nodes
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     j1 = Nodes(sim) ["J1"]
...     print j1.is_junction()
>>> True
```

**is\_outfall()**

Check if node is a Outfall Type.

**Returns** is outfall

**Return type** bool

Examples:

```
>>> from pyswmm import Simulation, Nodes
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     j1 = Nodes(sim) ["J1"]
...     print j1.is_outfall()
>>> True
```

**is\_storage()**

Check if node is a Storage Type.

**Returns** is storage

**Return type** bool

Examples:

```
>>> from pyswmm import Simulation, Nodes
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     j1 = Nodes(sim) ["J1"]
...     print j1.is_storage()
>>> True
```

**lateral\_inflow**

Get Node Results for lateral Inflow rate.

If Simulation is not running this method will raise a warning and return 0.

**Returns** Parameter Value

**Return type** float

Examples:

```
>>> from pyswmm import Simulation, Nodes
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     j1 = Nodes(sim) ["J1"]
...     for step in sim:
...         print j1.lateral_inflow
>>> 0
>>> 0.25
>>> 0.25
>>> 0.3
>>> 0.4
```

**losses**

Get Node Results for Losses Rate (Evap and Exfiltration).

If Simulation is not running this method will raise a warning and return 0.

**Returns** Parameter Value

**Return type** float

Examples:

```

>>> from pyswmm import Simulation, Nodes
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     j1 = Nodes(sim) ["J1"]
...     for step in sim:
...         print j1.losses
>>> 0
>>> 0.01
>>> 0.01
>>> 0.01
>>> 0.01

```

**nodeid**

Get Node ID.

**Returns** Parameter Value

**Return type** float

Examples:

```

>>> from pyswmm import Simulation, Nodes
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     j1 = Nodes(sim) ["J1"]
...     print j1.nodeid
>>> J1

```

**ponding\_area**

Get/set node ponding area.

**Returns** Parameter Value

**Return type** float

Examples:

```

>>> from pyswmm import Simulation, Nodes
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     j1 = Nodes(sim) ["J1"]
...     print j1.ponding_area
>>> 0

```

Setting the value

```

>>> from pyswmm import Simulation, Nodes
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     j1 = Nodes(sim) ["J1"]
...     print j1.ponding_area
...     j1.ponding_area = 50
...     print j1.ponding_area
>>> 0
>>> 50

```

**statistics**

Node Statistics. The stats returned are rolling/cumulative. Indexes are as follows:



average_depth
max_depth
max_depth_date
max_report_depth
flooding_volume
flooding_duration
surcharge_duration
courant_crit_duration
lateral_inflow_vol
peak_lateral_inflowrate
peak_total_inflow
peak_flooding_rate
max_ponded_volume
max_inflow_date
max_flooding_date

**Returns** Group of Stats

**Return type** dict

### surcharge\_depth

Get/set node surcharge depth.

**Returns** Parameter Value

**Return type** float

Examples:

```
>>> from pyswmm import Simulation, Nodes
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     j1 = Nodes(sim) ["J1"]
...     print j1.surcharge_depth
>>> 10
```

Setting the value

```
>>> from pyswmm import Simulation, Nodes
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     j1 = Nodes(sim) ["J1"]
...     print j1.surcharge_depth
...     j1.surcharge_depth = 50
...     print j1.surcharge_depth
>>> 10
>>> 50
```

### total\_inflow

Get Node Results for Total Inflow Rate.

If Simulation is not running this method will raise a warning and return 0.

**Returns** Parameter Value

**Return type** float

Examples:

```

>>> from pyswmm import Simulation, Nodes
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     j1 = Nodes(sim) ["J1"]
...     for step in sim:
...         print j1.total_inflow
>>> 0
>>> 1.2
>>> 1.5
>>> 1.9
>>> 1.2

```

**total\_outflow**

Get Node Results for Total Outflow Rate.

If Simulation is not running this method will raise a warning and return 0.

**Returns** Parameter Value

**Return type** float

Examples:

```

>>> from pyswmm import Simulation, Nodes
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     j1 = Nodes(sim) ["J1"]
...     for step in sim:
...         print j1.total_outflow
>>> 0
>>> 1.2
>>> 1.5
>>> 1.9
>>> 1.2

```

**volume**

Get Node Results for Volume.

If Simulation is not running this method will raise a warning and return 0.

**Returns** Parameter Value

**Return type** float

Examples:

```

>>> from pyswmm import Simulation, Nodes
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     j1 = Nodes(sim) ["J1"]
...     for step in sim:
...         print j1.volume
>>> 0
>>> 1.2
>>> 1.5
>>> 1.9
>>> 1.2

```

**class** pyswmm.nodes.Outfall

Bases: *pyswmm.nodes.Node*

Outfall Object: Subclass of Node Object.

**cumulative\_inflow**

Get Cumulative Outfall Loading.

If Simulation is not running this method will raise a warning and return 0.

**Returns** Cumulative Volume

**Return type** float

**outfall\_stage** (*stage*)

Generate and Set an Outfall Stage (head).

The value is held constant in the model until it is redefined. Using the function overrides the mechanism within SWMM that would internally set the outfall stage. This does not introduce any continuity errors since all flows is counted as an inflow.

**Parameters** *stage* (*float*) – Outfall Stage (Head)

Examples:

```
>>> from pyswmm import Simulation, Nodes
>>>
>>> with Simulation('tests/data/TestModel1_weirSetting.inp') as sim:
...     j1 = Nodes(sim) ["J1"]
...     for step in sim:
...         j1.outfall_stage(9)
>>>
```

**outfall\_statistics**

Outfall Stats. The stats returned are rolling/cumulative. Indexes are as follows:

average_flowrate
peak_flowrate
pollutant_loading
total_periods

**Returns** Group of Stats

**Return type** list

**class** pyswmm.nodes.Storage

Bases: *pyswmm.nodes.Node*

Storage Object: Subclass of Node Object.

**storage\_statistics**

Storage Stats. The stats returned are rolling/cumulative. Indexes are as follows:

initial_volume
average_volume
max_volume
peak_flowrate
evap_loss
exfil_loss
max_vol_date

**Returns** Group of Stats

Return type `list`

## 6.4 links module

Links module for the pythonic interface to SWMM5.

**class** `pyswmm.links.Links` (*model*)

Bases: `object`

Link Iterator Methods.

**Parameters** `model` (*object*) – Open Model Instance

Examples:

```
>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModel1_weirSetting.inp') as sim:
...     for link in Links(sim):
...         print link
...         print link.linkid
...
>>> <swmm5.Link object at 0x031B0350>
>>> C1
>>> <swmm5.Link object at 0x030693D0>
>>> C2
>>> <swmm5.Link object at 0x031B0350>
>>> C3
>>> <swmm5.Link object at 0x030693D0>
>>> C0
```

Iterating or Links Object

```
>>> links = Links(sim)
>>> for link in links:
...     print link.linkid
>>> C1:C2
>>> C2
>>> C3
```

Testing Existence

```
>>> links = Links(sim)
>>> "C1:C2" in links
>>> True
```

Initializing a link Object

```
>>> links = Links(sim)
>>> clc2 = links['C1:C2']
>>> clc2.flow_limit = 12
>>> clc2.flow_limit
>>> 12
```

**next** ()

**class** `pyswmm.links.Link` (*model*, *linkid*)

Bases: `object`

Link Methods.

### Parameters

- **model** (*object*) – Open Model Instance
- **linkid** (*str*) – Link ID

Examples:

```
>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     clc2 = Links(sim) ["C1:C2"]
...     print clc2.flow
...     for step in simulation:
...         print clc2.flow
... 0.0
```

### average\_head\_loss

Get/set Average Conduit Loss.

**Returns** Parameter Value

**Return type** float

Examples:

```
>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     clc2 = Links(sim) ["C1:C2"]
...     print clc2.average_head_loss
>>> 0
```

Setting the value

```
>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     clc2 = Links(sim) ["C1:C2"]
...     print clc2.average_head_loss
...     clc2.average_head_loss = 0.2
...     print clc2.average_head_loss
>>> 0
>>> 0.2
```

### connections

Get link upstream and downstream node IDs.

**Returns** (“UpstreamNodeID”, “DownstreamNodeID”)

**Return type** tuple

Examples:

```
>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     clc2 = Links(sim) ["C1:C2"]
...     print clc2.connections
>>> ("C1", "C2")
```

**current\_setting**

Get Link current setting.

If Simulation is not running this method will raise a warning and return 0.

**Returns** Parameter Value

**Return type** float

Examples:

```
>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     clc2 = Links(sim) ["C1:C2"]
...     for step in sim:
...         print clc2.current_setting
>>> 0
>>> 1
>>> 0
>>> 0.5
>>> 1
```

**depth**

Get Link Results for Depth.

If Simulation is not running this method will raise a warning and return 0.

**Returns** Parameter Value

**Return type** float

Examples:

```
>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     clc2 = Links(sim) ["C1:C2"]
...     for step in sim:
...         print clc2.depth
>>> 0
>>> 1.2
>>> 1.5
>>> 1.9
>>> 1.2
```

**ds\_xsection\_area**

Get Link Results for Downstream X-section Flow Area.

If Simulation is not running this method will raise a warning and return 0.

**Returns** Parameter Value

**Return type** float

Examples:

```
>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     clc2 = Links(sim) ["C1:C2"]
...     for step in sim:
```

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```

...     print c1c2.ds_xsection_area
>>> 0
>>> 1.2
>>> 1.5
>>> 1.9
>>> 1.2

```

**flow**

Get Link Results for Flow.

If Simulation is not running this method will raise a warning and return 0.

**Returns** Parameter Value

**Return type** float

Examples:

```

>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     c1c2 = Links(sim) ["C1:C2"]
...     for step in sim:
...         print c1c2.flow
>>> 0
>>> 1.2
>>> 1.5
>>> 1.9
>>> 1.2

```

**flow\_limit**

Get/set link flow limit.

**Returns** Parameter Value

**Return type** float

Examples:

```

>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     c1c2 = Links(sim) ["C1:C2"]
...     print c1c2.flow_limit
>>> 0

```

Setting the Value

```

>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     c1c2 = Links(sim) ["C1:C2"]
...     print c1c2.flow_limit
...     c1c2.flow_limit = 0.2
...     print c1c2.flow_limit
>>> 0
>>> 0.2

```

**froude**

Get Link Results for Froude.

If Simulation is not running this method will raise a warning and return 0.

**Returns** Parameter Value

**Return type** float

Examples:

```
>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     c1c2 = Links(sim) ["C1:C2"]
...     for step in sim:
...         print c1c2.froude
>>> 0
>>> 1.2
>>> 1.5
>>> 1.9
>>> 1.2
```

### initial\_flow

Get/set Link Initial Flow.

**Returns** Parameter Value

**Return type** float

Examples:

```
>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     c1c2 = Links(sim) ["C1:C2"]
...     print c1c2.initial_flow
>>> 0
```

Setting the Value

```
>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     c1c2 = Links(sim) ["C1:C2"]
...     print c1c2.initial_flow
...     c1c2.initial_flow = 0.2
...     print c1c2.initial_flow
>>> 0.1
>>> 0.2
```

### inlet\_head\_loss

Get/set Inlet Head Loss.

**Returns** Parameter Value

**Return type** float

Examples:

```
>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     c1c2 = Links(sim) ["C1:C2"]
```

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```
...     print c1c2.inlet_head_loss
>>> 0
```

**Setting the Value**

```
>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     c1c2 = Links(sim) ["C1:C2"]
...     print c1c2.inlet_head_loss
...     c1c2.inlet_head_loss = 0.2
...     print c1c2.inlet_head_loss
>>> 0
>>> 0.2
```

**inlet\_node**

Get link inlet node ID.

**Returns** Inlet node ID**Return type** str

Examples:

```
>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     c1c2 = Links(sim) ["C1:C2"]
...     print c1c2.inlet_node
>>> C1
```

**inlet\_offset**

Get/set Upstream Offset Depth.

**Returns** Parameter Value**Return type** float

Examples:

```
>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     c1c2 = Links(sim) ["C1:C2"]
...     print c1c2.inlet_offset
>>> 0.1
```

**Setting the value**

```
>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     c1c2 = Links(sim) ["C1:C2"]
...     print c1c2.inlet_offset
...     c1c2.inlet_offset = 0.2
...     print c1c2.inlet_offset
>>> 0.1
>>> 0.2
```

**is\_conduit()**

Check if link is a Conduit Type.

**Returns** is conduit**Return type** bool

Examples:

```
>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     clc2 = Links(sim) ["C1:C2"]
...     print clc2.is_conduit()
>>> True
```

**is\_orifice()**

Check if link is a Orifice Type.

**Returns** is orife**Return type** bool

Examples:

```
>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     clc2 = Links(sim) ["C1:C2"]
...     print clc2.is_orifice()
>>> False
```

**is\_outlet()**

Check if link is a Outlet Type.

**Returns** is outlet**Return type** bool

Examples:

```
>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     clc2 = Links(sim) ["C1:C2"]
...     print clc2.is_outlet()
>>> False
```

**is\_pump()**

Check if link is a Pump Type.

**Returns** is pump**Return type** bool

Examples:

```
>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     clc2 = Links(sim) ["C1:C2"]
```

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```
...     print c1c2.is_pump()
>>> False
```

**is\_weir()**

Check if link is a Weir Type.

**Returns** is weir**Return type** bool

Examples:

```
>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     c1c2 = Links(sim) ["C1:C2"]
...     print c1c2.is_weir()
>>> False
```

**linkid**

Get Link ID.

**Returns** Parameter Value**Return type** float

Examples:

```
>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     c1c2 = Links(sim) ["C1:C2"]
...     print c1c2.linkid
>>> "C1"
```

**outlet\_head\_loss**

Get/set Outlet Head Loss.

**Returns** Parameter Value**Return type** float

Examples:

```
>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     c1c2 = Links(sim) ["C1:C2"]
...     print c1c2.outlet_head_loss
>>> 0
```

Setting the Value

```
>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     c1c2 = Links(sim) ["C1:C2"]
...     print c1c2.outlet_head_loss
...     c1c2.outlet_head_loss = 0.2
```

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```
...     print c1c2.outlet_head_loss
>>> 0
>>> 0.2
```

**outlet\_node**

Get link outlet node ID.

**Returns** Outlet node ID**Return type** str

Examples:

```
>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     c1c2 = Links(sim) ["C1:C2"]
...     print c1c2.outlet_node
>>> C2
```

**outlet\_offset**

Get/set Downstream Offset Depth.

**Returns** Parameter Value**Return type** float

Examples:

```
>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     c1c2 = Links(sim) ["C1:C2"]
...     print c1c2.outlet_offset
>>> 0.1
```

Setting the value

```
>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     c1c2 = Links(sim) ["C1:C2"]
...     print c1c2.outlet_offset
...     c1c2.outlet_offset = 0.2
...     print c1c2.outlet_offset
>>> 0.1
>>> 0.2
```

**seepage\_rate**

Get/set Conduit Seepage Loss.

**Returns** Parameter Value**Return type** float

Examples:

```
>>> from pyswmm import Simulation, Links
>>>
```

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```
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     clc2 = Links(sim) ["C1:C2"]
...     print clc2.seepage_rate
>>> 0
```

### Setting the Value

```
>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     clc2 = Links(sim) ["C1:C2"]
...     print clc2.seepage_rate
...     clc2.seepagerate = 0.2
...     print clc2.seepage_rate
>>> 0
>>> 0.2
```

### target\_setting

Get/set Link Target Setting.

If Simulation is not running this method will raise a warning and return 0.

**Returns** Parameter Value

**Return type** float

Examples:

```
>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     clc2 = Links(sim) ["C1:C2"]
...     for step in sim:
...         print clc2.target_setting
>>> 0
>>> 0
>>> 1
>>> 0.5
>>> 1
```

### Setting the Value

```
>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     clc2 = Links(sim) ["C1:C2"]
...     for step in sim:
...         print clc2.target_setting
...         if clc2.flow > 3:
...             clc2.target_setting = 0.1
>>> 0
>>> 0
>>> 0.1
>>> 0.1
>>> 0.1
```

### ups\_xsection\_area

Get Link Results for Upstream X-section Flow Area.

If Simulation is not running this method will raise a warning and return 0.

**Returns** Parameter Value

**Return type** float

Examples:

```
>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     c1c2 = Links(sim) ["C1:C2"]
...     for step in sim:
...         print c1c2.ups_xsection_area
>>> 0
>>> 1.2
>>> 1.5
>>> 1.9
>>> 1.2
```

#### **volume**

Get Link Results for Volume.

If Simulation is not running this method will raise a warning and return 0.

**Returns** Parameter Value

**Return type** float

Examples:

```
>>> from pyswmm import Simulation, Links
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     c1c2 = Links(sim) ["C1:C2"]
...     for step in sim:
...         print c1c2.volume
>>> 0
>>> 1.2
>>> 1.5
>>> 1.9
>>> 1.2
```

#### **class** pyswmm.links.Conduit

Bases: *pyswmm.links.Link*

Conduit Object: Subclass of Link Object.

#### **conduit\_statistics**

Conduit Flow Stats. The stats returned are rolling/cumulative. Indeces are as follows:

peak_flow
peak_flow_date
peak_velocity
peak_depth
time_normal_flow
time_inlet_control
time_surcharged
time_full_upstream
time_full_downstream
time_full_flow
time_capacity_limited
time_in_flow_class
time_courant_crit
flow_turns
flow_turn_sign

Time in Flow Class: (Fraction of Total Time)

0	1	2	3	4	5	6
Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit

**Returns** Group of Stats

**Return type** dict

**class** pyswmm.links.Pump

Bases: *pyswmm.links.Link*

Pump Object: Subclass of Link Object.

**pump\_statistics**

Pump Stats. The stats returned are rolling/cumulative. Indices are as follows:

percent_utilized
min_flowrate
average_flowrate
max_flowrate
total_volume
energy_consumed
off_curve_low
off_curve_high
number_startups
total_periods

**Returns** Group of Stats

**Return type** dict

## 6.5 lidcontrols module

**class** pyswmm.lidcontrols.LidControl (*sim, model, lidcontrolid*)

Bases: object

**can\_overflow**

Get lid control surface layer option for immediate outflow of excess water

**Returns** Parameter Value

**Return type** char

**class** pyswmm.lidcontrols.LidControls (*model*)

Bases: `object`

Lid Control Iterator Methods.

**Parameters** *model* (*object*) – Open Model Instance

**next** ()

## 6.6 lidgroups module

**class** pyswmm.lidgroups.LidGroup (*model*, *subcatchmentid*)

Bases: `object`

**flow\_to\_pervious**

Get lid group total flow sent to pervious area

**Returns** Parameter Value

**Return type** double

**new\_drain\_flow**

Get lid group total drain flow in current period

**Returns** Parameter Value

**Return type** double

**next** ()

**old\_drain\_flow**

Get lid group total drain flow in pervious period

**Returns** Parameter Value

**Return type** double

**pervious\_area**

Get lid group amount of pervious area

**Returns** Parameter Value

**Return type** double

**class** pyswmm.lidgroups.LidGroups (*model*)

Bases: `object`

LidGroups Iterator Methods.

**Parameters** *model* (*object*) – Open Model Instance

**next** ()

**class** pyswmm.lidgroups.LidUnit (*model*, *subcatchmentid*, *lidid*)

Bases: `object`

Lid Unit Methods.



**Parameters**

- **model** (*object*) – Open Model Instance
- **subcatchmentid** (*str*) – Subcatchment ID
- **lidid** (*str*) – Lid unit ID

## Lid Unit Parameters

Parameter	Getter	Setter Before Sim	Setter During Sim
subcatchment	enabled	disabled	disabled
lid_control	enabled	disabled	disabled
unit_area	enabled	enabled	disabled
full_width	enabled	enabled	disabled
initial_saturation	enabled	enabled	disabled
from_impervious	enabled	enabled	disabled
from_pervious	enabled	enabled	disabled
index	enabled	enabled	disabled
number	enabled	enabled	disabled
to_pervious	enabled	enabled	disabled
drain_subcatchment	enabled	enabled	enabled
drain_node	enabled	enabled	enabled

**drain\_node**

Get lid drain to node index Negative if no receiving node

**Returns** Parameter Value

**Return type** `int`

**drain\_subcatchment**

Get lid drain to subcatchment index Negative if no receiving subcatchment

**Returns** Parameter Value

**Return type** `int`

**dry\_time**

Get lid time since last rainfall (sec)

**Returns** Parameter Value

**Return type** `double`

**evaporation**

Get lid current evaporation rate

**Returns** Parameter Value

**Return type** `double`

**from\_impervious**

Get lid fraction of impervious area runoff treated

**Returns** Parameter Value

**Return type** `double`

**from\_pervious**

Get lid fraction of pervious area runoff treated

**Returns** Parameter Value

**Return type** double

**full\_width**

Get lid unit full top width.

**Returns** Parameter Value

**Return type** double

**index**

Get lid control index

**Returns** Parameter Value

**Return type** int

**initial\_saturation**

Get lid initial saturation of soil and storage layers.

**Returns** Parameter Value

**Return type** double

**lid\_control**

**native\_infiltration**

Get lid native infiltration rate limit

**Returns** Parameter Value

**Return type** double

**new\_drain\_flow**

Get lid current drain flow

**Returns** Parameter Value

**Return type** double

**number**

Get lid number of replicate units

**Returns** Parameter Value

**Return type** int

**old\_drain\_flow**

Get lid pervious drain flow

**Returns** Parameter Value

**Return type** double

**subcatchment**

**to\_pervious**

Get lid to pervious area (1 if outflow sent to pervious area) (0 if not)

**Returns** Parameter Value

**Return type** int

**unit\_area**

Get lid unit area.

**Returns** Parameter Value

**Return type** double

## 6.7 lidlayers module

**class** pyswmm.lidlayers.**Drain** (*model, lidcontrol*)

Bases: `object`

Layer	Parameter	Setter Before Sim	Setter During Sim
Drain	coefficient	enabled	enabled
Drain	exponent	enabled	enabled
Drain	offset	enabled	enabled
Drain	delay	enabled	enabled
Drain	open_head	enabled	enabled
Drain	close_head	enabled	enabled

### **close\_head**

Get lid control drain layer head when drain closes (ft)

**Returns** Parameter Value

**Return type** double

### **coefficient**

Get lid control drain layer underdrain flow coefficient

**Returns** Parameter Value

**Return type** double

### **delay**

Get lid control drain layer rain barrel drain delay time (sec)

**Returns** Parameter Value

**Return type** double

### **exponent**

Get lid control drain layer underdrain head exponent

**Returns** Parameter Value

**Return type** double

### **offset**

Get lid control drain layer offset height of underdrain

**Returns** Parameter Value

**Return type** double

### **open\_head**

Get lid control drain layer head when drain opens (ft)

**Returns** Parameter Value

**Return type** double

**class** pyswmm.lidlayers.**DrainMat** (*model, lidcontrol*)

Bases: `object`

Layer	Parameter	Setter Before Sim	Setter During Sim
DrainMat	thickness	enabled	disabled
DrainMat	void_fraction	enabled	disabled
DrainMat	roughness	enabled	enabled
DrainMat	alpha	enabled	disabled

**alpha**

Get lid control drainmat layer slope/roughness term in Manning equation

**Returns** Parameter Value

**Return type** double

**roughness**

Get lid control drainmat layer Mannings n for green roof drainage mats

**Returns** Parameter Value

**Return type** double

**thickness**

Get lid control drainmat layer thickness

**Returns** Parameter Value

**Return type** double

**void\_fraction**

Get lid control drainmat layer void volume / total volume

**Returns** Parameter Value

**Return type** double

**class** `pyswmm.lidlayers.Pavement` (*model, lidcontrol*)

Bases: `object`

Layer	Parameter	Setter Before Sim	Setter During Sim
Pavement	thickness	enabled	disabled
Pavement	void_fraction	enabled	disabled
Pavement	impervious_fraction	enabled	disabled
Pavement	k_saturated	enabled	disabled
Pavement	clog_factor	enabled	enabled
Pavement	regeneration	enabled	disabled
Pavement	regeneration_degree	enabled	disabled

**clog\_factor**

Get lid control pavement layer clogging factor

**Returns** Parameter Value

**Return type** double

**impervious\_fraction**

Get lid control pavement layer impervious area fraction

**Returns** Parameter Value

**Return type** double

**k\_saturated**

Get lid control pavement layer permeability

**Returns** Parameter Value

**Return type** double

**regeneration**

Get lid control pavement layer clogging regeneration interval (days)

**Returns** Parameter Value

**Return type** double

**regeneration\_degree**

Get lid control pavement layer clogging regeneration degree

**Returns** Parameter Value

**Return type** double

**thickness**

Get lid control pavement layer thickness

**Returns** Parameter Value

**Return type** double

**void\_fraction**

Get lid control pavement layer void volume / total volume

**Returns** Parameter Value

**Return type** double

**class** pyswmm.lidlayers.**Soil** (*model, lidcontrol*)

Bases: `object`

Layer	Parameter	Setter Before Sim	Setter During Sim
Soil	thickness	enabled	disabled
Soil	porosity	enabled	disabled
Soil	field_capacity	enabled	disabled
Soil	wilting_point	enabled	disabled
Soil	k_saturated	enabled	disabled
Soil	k_slope	enabled	disabled
Soil	suction_head	enabled	disabled

**field\_capacity**

Get lid control soil layer field capacity

**Returns** Parameter Value

**Return type** double

**k\_saturated**

Get lid control soil layer saturated hydraulic conductivity

**Returns** Parameter Value

**Return type** double

**k\_slope**

Get lid control soil layer slope of log(k) v. moisture content curve

**Returns** Parameter Value

**Return type** double

**porosity**

Get lid control soil layer void volume / total volume

**Returns** Parameter Value

**Return type** double

**suction\_head**

Get lid control soil layer suction head at wetting front

**Returns** Parameter Value

**Return type** double

**thickness**

Get lid control soil layer thickness

**Returns** Parameter Value

**Return type** double

**wilting\_point**

Get lid control soil layer wilting point

**Returns** Parameter Value

**Return type** double

**class** `pyswmm.lidlayers.Storage` (*model, lidcontrol*)

Bases: `object`

Layer	Parameter	Setter Before Sim	Setter During Sim
Storage	thickness	enabled	disabled
Storage	void_fraction	enabled	disabled
Storage	k_saturated	enabled	disabled
Storage	clog_factor	enabled	enabled

**clog\_factor**

Get lid control storage layer clogging factor

**Returns** Parameter Value

**Return type** double

**k\_saturated**

Get lid control storage layer saturated hydraulic conductivity

**Returns** Parameter Value

**Return type** double

**thickness**

Get lid control storage layer thickness

**Returns** Parameter Value

**Return type** double

**void\_fraction**

Get lid control storage layer void volume / total volume

**Returns** Parameter Value

**Return type** double

**class** pyswmm.lidlayers.**Surface** (*model, lidcontrol*)

Bases: `object`

Layer	Parameter	Setter Before Sim	Setter During Sim
Surface	thickness	enabled	disabled
Surface	void_fraction	enabled	disabled
Surface	roughness	enabled	enabled
Surface	slope	enabled	disabled
Surface	side_slope	enabled	disabled
Surface	alpha	enabled	disabled

**alpha**

Get lid control surface layer swale side slope (run/rise)

**Returns** Parameter Value

**Return type** double

**roughness**

Get lid control surface layer surface Mannings n

**Returns** Parameter Value

**Return type** double

**side\_slope**

Get lid control surface layer swale side slope (run/rise)

**Returns** Parameter Value

**Return type** double

**slope**

Get lid control surface layer land surface slope (fraction)

**Returns** Parameter Value

**Return type** double

**thickness**

Get lid control surface layer thickness

**Returns** Parameter Value

**Return type** double

**void\_fraction**

Get lid control surface layer available fraction of storage volume

**Returns** Parameter Value

**Return type** double

## 6.8 lidunits module

**class** pyswmm.lidunits.**Pavement** (*model, lidunit*)

Bases: `object`

**depth**

Get lid depth of water in porous pavement layer

**Returns** Parameter Value

**Return type** double

**evaporation**

Get lid evaporation from pavement layer

**Returns** Parameter Value

**Return type** double

**flux\_rate**

Get lid flux rate from pavement layer

**Returns** Parameter Value

**Return type** double

**percolation**

Get lid percolation from pavement layer

**Returns** Parameter Value

**Return type** double

**class** `pyswmm.lidunits.Soil` (*model, lidunit*)

Bases: `object`

**evaporation**

Get lid evaporation from soil layer

**Returns** Parameter Value

**Return type** double

**flux\_rate**

Get lid flux rate from soil layer

**Returns** Parameter Value

**Return type** double

**moisture**

Get lid moisture content of biocell soil layer

**Returns** Parameter Value

**Return type** double

**percolation**

Get lid percolation from soil layer

**Returns** Parameter Value

**Return type** double

**class** `pyswmm.lidunits.Storage` (*model, lidunit*)

Bases: `object`

**depth**

Get lid depth of water in storage layer

**Returns** Parameter Value

**Return type** double



**drain**

Get lid drain rate from storage layer

**Returns** Parameter Value

**Return type** double

**evaporation**

Get lid evaporation rate from storage layer

**Returns** Parameter Value

**Return type** double

**exfiltration**

Get lid exfiltration rate from storage layer

**Returns** Parameter Value

**Return type** double

**flux\_rate**

Get lid flux rate from storage layer

**Returns** Parameter Value

**Return type** double

**inflow**

Get lid inflow rate to storage rate

**Returns** Parameter Value

**Return type** double

**class** pyswmm.lidunits.**Surface** (*model, lidunit*)

Bases: `object`

**depth**

Get lid depth of ponded water on surface layer

**Returns** Parameter Value

**Return type** double

**evaporation**

Get lid evaporation rate from surface layer

**Returns** Parameter Value

**Return type** double

**flux\_rate**

Get lid flux rate from surface layer

**Returns** Parameter Value

**Return type** double

**infiltration**

Get lid infiltration rate from surface layer

**Returns** Parameter Value

**Return type** double

**inflow**

Get lid precip. + runoff to LID unit

**Returns** Parameter Value

**Return type** double

**outflow**

Get lid outflow from surface layer

**Returns** Parameter Value

**Return type** double

**class** pyswmm.lidunits.**WaterBalance** (*model, lidunit*)

Bases: `object`

**drain\_flow**

Get lid water balance total underdrain flow

**Returns** Parameter Value

**Return type** double

**evaporation**

Get lid water balance total evaporation

**Returns** Parameter Value

**Return type** double

**final\_volume**

Get lid water balance final stored volume

**Returns** Parameter Value

**Return type** double

**infiltration**

Get lid water balance total infiltration

**Returns** Parameter Value

**Return type** double

**inflow**

Get lid water balance total inflow

**Returns** Parameter Value

**Return type** double

**initial\_volume**

Get lid water balance initial stored volume

**Returns** Parameter Value

**Return type** double

**surface\_flow**

Get lid water balance total surface runoff

**Returns** Parameter Value

**Return type** double

## 6.9 raingages module

Raingages module for the pythonic interface to SWMM5.

**class** pyswmm.raingages.**RainGage** (*model*, *raingageid*)

Bases: `object`

Raingage Methods.

### Parameters

- **model** (*object*) – Open Model Instance
- **raingageid** (*str*) – Raingage ID

Examples:

```
>>> from pyswmm import Simulation, Raingages
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     rg1 = Raingages(sim) ["Gage1"]
...     print(rg1.raingageid)
...     for step in simulation:
...         print(rg1.total_precip)
... Gage1
... 0
... 10
```

### rainfall

Get raingage total rainfall rate (like in/hr or mm/hr).

**Returns** Parameter Value

**Return type** `float`

Examples:

```
>>> from pyswmm import Simulation, RainGages
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     rg1 = RainGages(sim) ["Gage1"]
...     print(rg1.rainfall)
>>> 1.0
```

### raingageid

Get Rain Gage ID.

**Returns** Parameter Value

**Return type** `float`

Examples:

```
>>> from pyswmm import Simulation, RainGages
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     rg = RainGage(sim) ["Gage1"]
...     print(rg.raingageid)
>>> Gage1
```

### snowfall

Get raingage total snowfall rate (like in/hr or mm/hr).

**Returns** Parameter Value

**Return type** float

Examples:

```
>>> from pyswmm import Simulation, RainGages
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     rg1 = RainGages(sim) ["Gage1"]
...     print(rg1.snowfall)
>>> 0.0
```

### **total\_precip**

Get/set raingage total precipitation rate (like in/hr or mm/hr).

**Returns** Parameter Value

**Return type** float

Examples:

```
>>> from pyswmm import Simulation, RainGages
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     rg1 = RainGages(sim) ["Gage1"]
...     print(rg1.total_precip)
>>> 1.0
```

Setting the value

```
>>> from pyswmm import Simulation, RainGages
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     rg1 = RainGages(sim) ["Gage1"]
...     print(rg1.total_precip)
...     rg1.total_precip = 0.2
...     print(rg1.total_precip)
>>> 1.0
>>> 0.2
```

**class** pyswmm.raingages.**RainGages** (*model*)

Bases: `object`

Rain Gages Iterator Methods.

**Parameters** `model` (*object*) – Open Model Instance

Examples:

```
>>> from pyswmm import Simulation, Nodes
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     for raingage in RainGages(sim):
...         print(raingage)
...         print(raingage.raingageid)
...
>>> <swmm5.RainGage object at 0x031B0350>
>>> Gage1
>>> <swmm5.RainGage object at 0x030693D0>
>>> Gage4
```

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```
>>> <swmm5.RainGage object at 0x031B0350>
>>> Gage3
>>> <swmm5.RainGage object at 0x030693D0>
>>> Gage10
```

### Iterating over Nodes Object

```
>>> raingages = RainGages(sim)
>>> for raingage in raingages:
...     print(raingage.raingageid)
>>> Gage1
>>> Gage4
>>> Gage3
>>> Gage10
```

### Testing Existence

```
>>> raingages = RainGages(sim)
>>> "Gage1" in raingages
>>> True
```

### Initializing a node Object

```
>>> raingages = RainGages(sim)
>>> gage1 = raingages['Gage1']
>>> print(gage1.total_precip)
>>> 0.04
>>>
>>> gage1.total_precip = 1
>>> print(gage1.total_precip)
>>> 1
```

`next()`

## 6.10 subcatchments module

Subcatchments module for the pythonic interface to SWMM5.

**class** `pyswmm.subcatchments.Subcatchments` (*model*)

Bases: `object`

Subcatchment Iterator Methods.

**Parameters** `model` (*object*) – Open Model Instance

Examples:

```
>>> from pyswmm import Simulation, Subcatchments
>>>
>>> with Simulation('tests/data/TestModel1_weirSetting.inp') as sim:
...     for subcatchment in Subcatchments(sim):
...         print(subcatchment)
...         print(subcatchment.subcatchmentid)
...
>>> <swmm5.Subcatchment object at 0x031B0350>
>>> S1
```

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```

>>> <swmm5.Subcatchment object at 0x030693D0>
>>> S2
>>> <swmm5.Subcatchment object at 0x031B0350>
>>> S3
>>> <swmm5.Subcatchment object at 0x030693D0>
>>> S4

```

### Iterating over Subcatchments Object

```

>>> subcatchments = Subcatchments(sim)
>>> for subcatchment in subcatchments:
...     print subcatchment.subcatchmentid
>>> S0
>>> S1
>>> S2
>>> S3

```

### Testing Existence

```

>>> subcatchments = Subcatchments(sim)
>>> "S1" in subcatchments
>>> True

```

### Initializing a subcatchment Object

```

>>> subcatchments = Subcatchments(sim)
>>> s1 = subcatchments['S1']
>>> print(s1.area)
>>> 12
>>>
>>> s1.area = 200
>>> print(s1.area)
>>> 200

```

**next ()**

**class** pyswmm.subcatchments.**Subcatchment** (*model, subcatchmentid*)

Bases: `object`

Subcatchment Methods.

#### Parameters

- **model** (*object*) – Open Model Instance
- **subcatchmentid** (*str*) – Subcatchment ID

Examples:

```

>>> from pyswmm import Simulation, Subcatchments
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     s1 = Subcatchments(sim) ["S1"]
...     print s1.rainfall
...     for step in sim:
...         print s1.rainfall
... 0.04

```

**area**

Get/set subcatchment area.

**Returns** Parameter Value

**Return type** float

Examples:

```
>>> from pyswmm import Simulation, Subcatchments
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     s1 = Subcatchments(sim) ["S1"]
...     print s1.area
>>> 10
```

Setting the value

```
>>> from pyswmm import Simulation, Subcatchments
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     s1 = Subcatchments(sim) ["S1"]
...     print s1.area
...     s1.area = 50
...     print s1.area
>>> 10
>>> 50
```

**buildup**

Get Pollutant Results for Surface Buildup on a Subcatchment.

If Simulation is not running this method will raise a warning and return 0.

**Returns** Group of Subcatchment Surface Buildup Values.

**Return type** dict

Examples:

```
>>> from pyswmm import Simulation, Subcatchments
>>>
>>> with Simulation('tests/buildup-test.inp') as sim:
...     s1 = Subcatchments(sim) ["S1"]
...     for step in sim:
...         print(s1.buildup)
>>> {'test-pollutant': 8.0}
>>> {'test-pollutant': 8.0}
>>> {'test-pollutant': 7.998}
>>> {'test-pollutant': 7.991}
>>> {'test-pollutant': 7.981}
```

**concPonded**

Get Pollutant Results for Concentration of Pollutant in Poned Water on a Subcatchment.

If Simulation is not running this method will raise a warning and return 0.

**Returns** Group of Subcatchment Poned Water Quality Values.

**Return type** dict

Examples:

```
>>> from pyswmm import Simulation, Subcatchments
>>>
>>> with Simulation('tests/buildup-test.inp') as sim:
...     s1 = Subcatchments(sim) ["S1"]
...     for step in sim:
...         print(s1.concPonded)
>>> {'test-pollut1': 0.0, 'test-pollut2': 0.0}
>>> {'test-pollut1': 0.0, 'test-pollut2': 0.0}
>>> {'test-pollut1': 0.0, 'test-pollut2': 0.0}
```

### connection

Get Subcatchment Outlet Connection.

This function return the type of loading surface and the ID. The two load to objects are nodes and other subcatchments.

Node	2
Subcatchment	1

**Returns** (Loading Surface Type, ID)

**Return type** tuple

Examples:

```
>>> from pyswmm import Simulation, Subcatchments
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     s1 = Subcatchments(sim) ["S1"]
...     print s1.connection
>>> (2, 'J2')
```

### curb\_length

Get/set subcatchment curb length.

**Returns** Parameter Value

**Return type** float

Examples:

```
>>> from pyswmm import Simulation, Subcatchments
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     s1 = Subcatchments(sim) ["S1"]
...     print s1.curb_length
>>> 0
```

Setting the value

```
>>> from pyswmm import Simulation, Subcatchments
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     s1 = Subcatchments(sim) ["S1"]
...     print s1.curb_length
...     s1.curb_length = 100
...     print s1.curb_length
```

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```
>>> 0
>>> 100
```

**evaporation\_loss**

Get Subcatchment Results for evaporation loss.

If Simulation is not running this method will raise a warning and return 0.

**Returns** Parameter Value

**Return type** float

Examples:

```
>>> from pyswmm import Simulation, Subcatchments
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     s1 = Subcatchments(sim) ["S1"]
...     for step in sim:
...         print s1.evaporation_loss
>>> 0.01
>>> 0.01
>>> 0.01
>>> 0.01
>>> 0.01
```

**infiltration\_loss**

Get Subcatchment Results for Infiltration Loss.

If Simulation is not running this method will raise a warning and return 0.

**Returns** Parameter Value

**Return type** float

Examples:

```
>>> from pyswmm import Simulation, Subcatchments
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     s1 = Subcatchments(sim) ["S1"]
...     for step in sim:
...         print s1.infiltration_loss
>>> 0
>>> 0.01
>>> 0.01
>>> 0.01
>>> 0.01
```

**percent\_impervious**

Get/set subcatchment percent impervious.

**Returns** Parameter Value

**Return type** float

Examples:

```
>>> from pyswmm import Simulation, Subcatchments
>>>
```

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```
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     s1 = Subcatchments(sim) ["S1"]
...     print s1.percent_impervious
>>> 10
```

Setting the value

```
>>> from pyswmm import Simulation, Subcatchments
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     s1 = Subcatchments(sim) ["S1"]
...     print s1.percent_impervious
...     s1.percent_impervious = 50
...     print s1.percent_impervious
>>> 10
>>> 50
```

### rainfall

Get Subcatchment Results for Rainfall.

If Simulation is not running this method will raise a warning and return 0.

**Returns** Parameter Value

**Return type** float

Examples:

```
>>> from pyswmm import Simulation, Subcatchments
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     s1 = Subcatchments(sim) ["S1"]
...     for step in sim:
...         print s1.rainfall
>>> 0
>>> 1.2
>>> 1.5
>>> 1.9
>>> 1.2
```

### runoff

Get Subcatchment Results for Run Off Rate.

If Simulation is not running this method will raise a warning and return 0.

**Returns** Parameter Value

**Return type** float

Examples:

```
>>> from pyswmm import Simulation, Subcatchments
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     s1 = Subcatchments(sim) ["S1"]
...     for step in sim:
...         print s1.runoff
>>> 0
>>> 0
```

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```
>>> 0.01
>>> 0
>>> 0
```

**runon**

Get Subcatchment Results for Run On.

If Simulation is not running this method will raise a warning and return 0.

**Returns** Parameter Value

**Return type** float

Examples:

```
>>> from pyswmm import Simulation, Subcatchments
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     s1 = Subcatchments(sim) ["S1"]
...     for step in sim:
...         print s1.runon
>>> 0
>>> 1.2
>>> 1.5
>>> 1.9
>>> 1.2
```

**slope**

Get/set subcatchment slope.

**Returns** Parameter Value

**Return type** float

Examples:

```
>>> from pyswmm import Simulation, Subcatchments
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     s1 = Subcatchments(sim) ["S1"]
...     print s1.slope
>>> 0.01
```

Setting the value

```
>>> from pyswmm import Simulation, Subcatchments
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     s1 = Subcatchments(sim) ["S1"]
...     print s1.slope
...     s1.slope = 0.02
...     print s1.slope
>>> 0.1
>>> 0.2
```

**snow\_depth**

Get Subcatchment Results for Snow Depth.

If Simulation is not running this method will raise a warning and return 0.

**Returns** Parameter Value

**Return type** float

Examples:

```
>>> from pyswmm import Simulation, Subcatchments
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     s1 = Subcatchments(sim) ["S1"]
...     for step in sim:
...         print s1.snow_depth
>>> 0
>>> 0.5
>>> 0.51
>>> 0.52
>>> 0.49
```

**statistics**

Subcatchment Flow Stats. The stats returned are rolling/cumulative. Indices are as follows:

precipitation
runon
evaporation
infiltration
runoff
peak_runoff_rate

**Returns** Group of Stats

**Return type** dict

**subcatchmentid**

Get Subcatchment ID.

**Returns** Parameter Value

**Return type** float

Examples:

```
>>> from pyswmm import Simulation, Subcatchments
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     s1 = Subcatchments(sim) ["S1"]
...     print s1.subcatchmentid
>>> S1
```

**width**

Get/set subcatchment width.

**Returns** Parameter Value

**Return type** float

Examples:

```
>>> from pyswmm import Simulation, Subcatchments
>>>
```

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```
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     s1 = Subcatchments(sim) ["S1"]
...     print s1.width
>>> 100.0
```

Setting the value

```
>>> from pyswmm import Simulation, Subcatchments
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     s1 = Subcatchments(sim) ["S1"]
...     print s1.width
...     s1.width = 30
...     print s1.width
>>> 100
>>> 30
```

## 6.11 system module

System module for the pythonic interface to SWMM5.

**class** pyswmm.system.**SystemStats** (*model*)

Bases: *object*

System-Wide Flow and Runoff Routing Accumulation Volume Methods.

**Parameters** *model* (*object*) – Open Model Instance

Examples:

```
>>> from pyswmm import Simulation, SystemStats
>>>
>>> with Simulation('tests/data/TestModell_weirSetting.inp') as sim:
...     system_routing = SystemStats(sim)
...
...     for step in sim:
...         print system_routing.routing_stats
...         print system_routing.runoff_stats
```

**routing\_stats**

Get rolling/cumulative routing stats. Follow Data are returned:

dry_weather_inflow
wet_weather_inflow
groundwater_inflow
II_inflow
external_inflow
flooding
outflow
evaporation_loss
seepage_loss
reacted
initial_storage
final_storage
routing_error

**Returns** Statistics

**Return type** dict

**runoff\_stats**

Get rolling/cumulative runoff stats. Follow Data are returned:

rainfall
evaporation
infiltration
runoff
drains
runon
init_storage
final_storage
init_snow_cover
final_snow_cover
snow_removed
routing_error

**Returns** Statistics

**Return type** dict

## 6.12 lib module

SWMM5 compiled libraries. This module provides the user with some options for selecting the SWMM5 engine.

`lib.use(arg)`

Set the SWMM5 DLL.

This method allows the user to define the engine they would like to use for the simulation. It is important to understand that previous versions of EPA-SWMM5 do not have the expanded toolkit functionality. Therefore, only basic functionality for running a simulation is available.

To use this, the user should copy and rename their SWMM5 DLL into the `site-packages/pyswmm/lib/windows` directory. The example below outlines the steps. This should be done before Simulation is imported.

Examples:

```
>>> import pyswmm
>>> pyswmm.lib.use("swmm5")
>>>
>>> from pyswmm import Simulation
```

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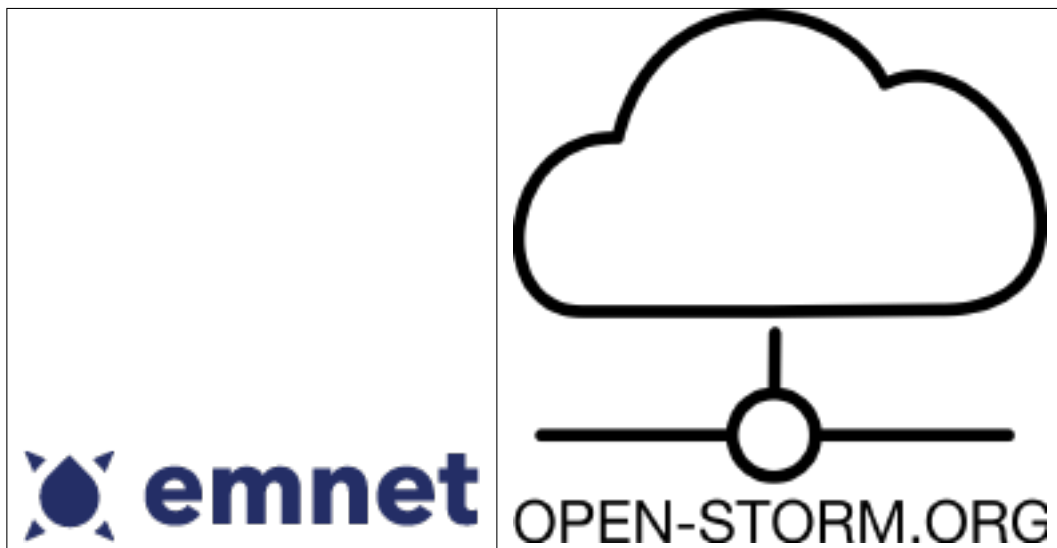


## CHAPTER 7

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## CHAPTER 8

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### Indices and tables

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- [genindex](#)
- [modindex](#)
- [search](#)
- [Glossary](#)



### I

lib, 66

### p

pyswmm.lidcontrols, 43

pyswmm.lidgroups, 44

pyswmm.lidlayers, 47

pyswmm.lidunits, 51

pyswmm.links, 32

pyswmm.nodes, 22

pyswmm.raingages, 55

pyswmm.simulation, 15

pyswmm.subcatchments, 57

pyswmm.system, 65



## A

`add_after_close()` (*pyswmm.simulation.Simulation* method), 16  
`add_after_end()` (*pyswmm.simulation.Simulation* method), 16  
`add_after_step()` (*pyswmm.simulation.Simulation* method), 16  
`add_before_end()` (*pyswmm.simulation.Simulation* method), 17  
`add_before_start()` (*pyswmm.simulation.Simulation* method), 17  
`add_before_step()` (*pyswmm.simulation.Simulation* method), 17  
`after_close()` (*pyswmm.simulation.Simulation* method), 17  
`after_end()` (*pyswmm.simulation.Simulation* method), 17  
`after_step()` (*pyswmm.simulation.Simulation* method), 17  
`alpha` (*pyswmm.lidlayers.DrainMat* attribute), 48  
`alpha` (*pyswmm.lidlayers.Surface* attribute), 51  
`area` (*pyswmm.subcatchments.Subcatchment* attribute), 58  
`average_head_loss` (*pyswmm.links.Link* attribute), 33

## B

`before_end()` (*pyswmm.simulation.Simulation* method), 17  
`before_start()` (*pyswmm.simulation.Simulation* method), 17  
`before_step()` (*pyswmm.simulation.Simulation* method), 18  
`buildup` (*pyswmm.subcatchments.Subcatchment* attribute), 59

## C

`can_overflow` (*pyswmm.lidcontrols.LidControl* attribute), 43  
`clog_factor` (*pyswmm.lidlayers.Pavement* attribute), 48  
`clog_factor` (*pyswmm.lidlayers.Storage* attribute), 50  
`close()` (*pyswmm.simulation.Simulation* method), 18  
`close_head` (*pyswmm.lidlayers.Drain* attribute), 47  
`coefficient` (*pyswmm.lidlayers.Drain* attribute), 47  
`concPonded` (*pyswmm.subcatchments.Subcatchment* attribute), 59  
`Conduit` (class in *pyswmm.links*), 42  
`conduit_statistics` (*pyswmm.links.Conduit* attribute), 42  
`connection` (*pyswmm.subcatchments.Subcatchment* attribute), 60  
`connections` (*pyswmm.links.Link* attribute), 33  
`cumulative_inflow` (*pyswmm.nodes.Outfall* attribute), 31  
`curb_length` (*pyswmm.subcatchments.Subcatchment* attribute), 60  
`current_setting` (*pyswmm.links.Link* attribute), 33  
`current_time` (*pyswmm.simulation.Simulation* attribute), 18

## D

`delay` (*pyswmm.lidlayers.Drain* attribute), 47  
`depth` (*pyswmm.lidunits.Pavement* attribute), 51  
`depth` (*pyswmm.lidunits.Storage* attribute), 52  
`depth` (*pyswmm.lidunits.Surface* attribute), 53  
`depth` (*pyswmm.links.Link* attribute), 34  
`depth` (*pyswmm.nodes.Node* attribute), 23  
`Drain` (class in *pyswmm.lidlayers*), 47  
`drain` (*pyswmm.lidunits.Storage* attribute), 52  
`drain_flow` (*pyswmm.lidunits.WaterBalance* attribute), 54  
`drain_node` (*pyswmm.lidgroups.LidUnit* attribute), 45  
`drain_subcatchment` (*pyswmm.lidgroups.LidUnit*

*attribute*), 45  
 DrainMat (*class in pyswmm.lidlayers*), 47  
 dry\_time (*pyswmm.lidgroups.LidUnit attribute*), 45  
 ds\_xsection\_area (*pyswmm.links.Link attribute*), 34

## E

end\_time (*pyswmm.simulation.Simulation attribute*), 18  
 engine\_version (*pyswmm.simulation.Simulation attribute*), 18  
 evaporation (*pyswmm.lidgroups.LidUnit attribute*), 45  
 evaporation (*pyswmm.lidunits.Pavement attribute*), 52  
 evaporation (*pyswmm.lidunits.Soil attribute*), 52  
 evaporation (*pyswmm.lidunits.Storage attribute*), 53  
 evaporation (*pyswmm.lidunits.Surface attribute*), 53  
 evaporation (*pyswmm.lidunits.WaterBalance attribute*), 54  
 evaporation\_loss (*pyswmm.subcatchments.Subcatchment attribute*), 61  
 execute() (*pyswmm.simulation.Simulation method*), 19  
 exfiltration (*pyswmm.lidunits.Storage attribute*), 53  
 exponent (*pyswmm.lidlayers.Drain attribute*), 47

## F

field\_capacity (*pyswmm.lidlayers.Soil attribute*), 49  
 final\_volume (*pyswmm.lidunits.WaterBalance attribute*), 54  
 flooding (*pyswmm.nodes.Node attribute*), 23  
 flow (*pyswmm.links.Link attribute*), 35  
 flow\_limit (*pyswmm.links.Link attribute*), 35  
 flow\_routing\_error (*pyswmm.simulation.Simulation attribute*), 19  
 flow\_to\_pervious (*pyswmm.lidgroups.LidGroup attribute*), 44  
 flow\_units (*pyswmm.simulation.Simulation attribute*), 19  
 flux\_rate (*pyswmm.lidunits.Pavement attribute*), 52  
 flux\_rate (*pyswmm.lidunits.Soil attribute*), 52  
 flux\_rate (*pyswmm.lidunits.Storage attribute*), 53  
 flux\_rate (*pyswmm.lidunits.Surface attribute*), 53  
 from\_impervious (*pyswmm.lidgroups.LidUnit attribute*), 45  
 from\_pervious (*pyswmm.lidgroups.LidUnit attribute*), 45  
 froude (*pyswmm.links.Link attribute*), 35  
 full\_depth (*pyswmm.nodes.Node attribute*), 24  
 full\_width (*pyswmm.lidgroups.LidUnit attribute*), 46

## G

generated\_inflow() (*pyswmm.nodes.Node method*), 24

## H

head (*pyswmm.nodes.Node attribute*), 25

## I

impervious\_fraction (*pyswmm.lidlayers.Pavement attribute*), 48  
 index (*pyswmm.lidgroups.LidUnit attribute*), 46  
 infiltration (*pyswmm.lidunits.Surface attribute*), 53  
 infiltration (*pyswmm.lidunits.WaterBalance attribute*), 54  
 infiltration\_loss (*pyswmm.subcatchments.Subcatchment attribute*), 61  
 inflow (*pyswmm.lidunits.Storage attribute*), 53  
 inflow (*pyswmm.lidunits.Surface attribute*), 53  
 inflow (*pyswmm.lidunits.WaterBalance attribute*), 54  
 initial\_conditions() (*pyswmm.simulation.Simulation method*), 19  
 initial\_depth (*pyswmm.nodes.Node attribute*), 25  
 initial\_flow (*pyswmm.links.Link attribute*), 36  
 initial\_saturation (*pyswmm.lidgroups.LidUnit attribute*), 46  
 initial\_volume (*pyswmm.lidunits.WaterBalance attribute*), 54  
 inlet\_head\_loss (*pyswmm.links.Link attribute*), 36  
 inlet\_node (*pyswmm.links.Link attribute*), 37  
 inlet\_offset (*pyswmm.links.Link attribute*), 37  
 invert\_elevation (*pyswmm.nodes.Node attribute*), 25  
 is\_conduit() (*pyswmm.links.Link method*), 37  
 is\_divider() (*pyswmm.nodes.Node method*), 26  
 is\_junction() (*pyswmm.nodes.Node method*), 26  
 is\_orifice() (*pyswmm.links.Link method*), 38  
 is\_outfall() (*pyswmm.nodes.Node method*), 26  
 is\_outlet() (*pyswmm.links.Link method*), 38  
 is\_pump() (*pyswmm.links.Link method*), 38  
 is\_storage() (*pyswmm.nodes.Node method*), 27  
 is\_weir() (*pyswmm.links.Link method*), 39

## K

k\_saturated (*pyswmm.lidlayers.Pavement attribute*), 48  
 k\_saturated (*pyswmm.lidlayers.Soil attribute*), 49  
 k\_saturated (*pyswmm.lidlayers.Storage attribute*), 50  
 k\_slope (*pyswmm.lidlayers.Soil attribute*), 49



## L

lateral\_inflow (*pyswmm.nodes.Node* attribute), 27  
 lib (module), 66  
 lid\_control (*pyswmm.lidgroups.LidUnit* attribute), 46  
 LidControl (class in *pyswmm.lidcontrols*), 43  
 LidControls (class in *pyswmm.lidcontrols*), 44  
 LidGroup (class in *pyswmm.lidgroups*), 44  
 LidGroups (class in *pyswmm.lidgroups*), 44  
 LidUnit (class in *pyswmm.lidgroups*), 44  
 Link (class in *pyswmm.links*), 32  
 linkid (*pyswmm.links.Link* attribute), 39  
 Links (class in *pyswmm.links*), 32  
 losses (*pyswmm.nodes.Node* attribute), 27

## M

moisture (*pyswmm.lidunits.Soil* attribute), 52

## N

native\_infiltration (*pyswmm.lidgroups.LidUnit* attribute), 46  
 new\_drain\_flow (*pyswmm.lidgroups.LidGroup* attribute), 44  
 new\_drain\_flow (*pyswmm.lidgroups.LidUnit* attribute), 46  
 next () (*pyswmm.lidcontrols.LidControls* method), 44  
 next () (*pyswmm.lidgroups.LidGroup* method), 44  
 next () (*pyswmm.lidgroups.LidGroups* method), 44  
 next () (*pyswmm.links.Links* method), 32  
 next () (*pyswmm.nodes.Nodes* method), 23  
 next () (*pyswmm.raingages.RainGages* method), 57  
 next () (*pyswmm.simulation.Simulation* method), 20  
 next () (*pyswmm.subcatchments.Subcatchments* method), 58  
 Node (class in *pyswmm.nodes*), 23  
 nodeid (*pyswmm.nodes.Node* attribute), 28  
 Nodes (class in *pyswmm.nodes*), 22  
 number (*pyswmm.lidgroups.LidUnit* attribute), 46

## O

offset (*pyswmm.lidlayers.Drain* attribute), 47  
 old\_drain\_flow (*pyswmm.lidgroups.LidGroup* attribute), 44  
 old\_drain\_flow (*pyswmm.lidgroups.LidUnit* attribute), 46  
 open\_head (*pyswmm.lidlayers.Drain* attribute), 47  
 Outfall (class in *pyswmm.nodes*), 30  
 outfall\_stage () (*pyswmm.nodes.Outfall* method), 31  
 outfall\_statistics (*pyswmm.nodes.Outfall* attribute), 31  
 outflow (*pyswmm.lidunits.Surface* attribute), 54  
 outlet\_head\_loss (*pyswmm.links.Link* attribute), 39

outlet\_node (*pyswmm.links.Link* attribute), 40  
 outlet\_offset (*pyswmm.links.Link* attribute), 40

## P

Pavement (class in *pyswmm.lidlayers*), 48  
 Pavement (class in *pyswmm.lidunits*), 51  
 percent\_complete (*pyswmm.simulation.Simulation* attribute), 20  
 percent\_impervious (*pyswmm.subcatchments.Subcatchment* attribute), 61  
 percolation (*pyswmm.lidunits.Pavement* attribute), 52  
 percolation (*pyswmm.lidunits.Soil* attribute), 52  
 pervious\_area (*pyswmm.lidgroups.LidGroup* attribute), 44  
 ponding\_area (*pyswmm.nodes.Node* attribute), 28  
 porosity (*pyswmm.lidlayers.Soil* attribute), 50  
 Pump (class in *pyswmm.links*), 43  
 pump\_statistics (*pyswmm.links.Pump* attribute), 43  
 pyswmm.lidcontrols (module), 43  
 pyswmm.lidgroups (module), 44  
 pyswmm.lidlayers (module), 47  
 pyswmm.lidunits (module), 51  
 pyswmm.links (module), 32  
 pyswmm.nodes (module), 22  
 pyswmm.raingages (module), 55  
 pyswmm.simulation (module), 15  
 pyswmm.subcatchments (module), 57  
 pyswmm.system (module), 65

## Q

quality\_error (*pyswmm.simulation.Simulation* attribute), 20

## R

rainfall (*pyswmm.raingages.RainGage* attribute), 55  
 rainfall (*pyswmm.subcatchments.Subcatchment* attribute), 62  
 RainGage (class in *pyswmm.raingages*), 55  
 raingageid (*pyswmm.raingages.RainGage* attribute), 55  
 RainGages (class in *pyswmm.raingages*), 56  
 regeneration (*pyswmm.lidlayers.Pavement* attribute), 49  
 regeneration\_degree (*pyswmm.lidlayers.Pavement* attribute), 49  
 report () (*pyswmm.simulation.Simulation* method), 20  
 report\_start (*pyswmm.simulation.Simulation* attribute), 20  
 roughness (*pyswmm.lidlayers.DrainMat* attribute), 48  
 roughness (*pyswmm.lidlayers.Surface* attribute), 51

routing\_stats (*pyswmm.system.SystemStats attribute*), 65  
 runoff (*pyswmm.subcatchments.Subcatchment attribute*), 62  
 runoff\_error (*pyswmm.simulation.Simulation attribute*), 21  
 runoff\_stats (*pyswmm.system.SystemStats attribute*), 66  
 runon (*pyswmm.subcatchments.Subcatchment attribute*), 63

## S

seepage\_rate (*pyswmm.links.Link attribute*), 40  
 side\_slope (*pyswmm.lidlayers.Surface attribute*), 51  
 Simulation (*class in pyswmm.simulation*), 15  
 slope (*pyswmm.lidlayers.Surface attribute*), 51  
 slope (*pyswmm.subcatchments.Subcatchment attribute*), 63  
 snow\_depth (*pyswmm.subcatchments.Subcatchment attribute*), 63  
 snowfall (*pyswmm.raingages.RainGage attribute*), 55  
 Soil (*class in pyswmm.lidlayers*), 49  
 Soil (*class in pyswmm.lidunits*), 52  
 start() (*pyswmm.simulation.Simulation method*), 21  
 start\_time (*pyswmm.simulation.Simulation attribute*), 21  
 statistics (*pyswmm.nodes.Node attribute*), 28  
 statistics (*pyswmm.subcatchments.Subcatchment attribute*), 64  
 step\_advance() (*pyswmm.simulation.Simulation method*), 21  
 Storage (*class in pyswmm.lidlayers*), 50  
 Storage (*class in pyswmm.lidunits*), 52  
 Storage (*class in pyswmm.nodes*), 31  
 storage\_statistics (*pyswmm.nodes.Storage attribute*), 31  
 Subcatchment (*class in pyswmm.subcatchments*), 58  
 subcatchment (*pyswmm.lidgroups.LidUnit attribute*), 46  
 subcatchmentid (*pyswmm.subcatchments.Subcatchment attribute*), 64  
 Subcatchments (*class in pyswmm.subcatchments*), 57  
 suction\_head (*pyswmm.lidlayers.Soil attribute*), 50  
 surcharge\_depth (*pyswmm.nodes.Node attribute*), 29  
 Surface (*class in pyswmm.lidlayers*), 51  
 Surface (*class in pyswmm.lidunits*), 53  
 surface\_flow (*pyswmm.lidunits.WaterBalance attribute*), 54  
 system\_units (*pyswmm.simulation.Simulation attribute*), 21  
 SystemStats (*class in pyswmm.system*), 65

## T

target\_setting (*pyswmm.links.Link attribute*), 41  
 thickness (*pyswmm.lidlayers.DrainMat attribute*), 48  
 thickness (*pyswmm.lidlayers.Pavement attribute*), 49  
 thickness (*pyswmm.lidlayers.Soil attribute*), 50  
 thickness (*pyswmm.lidlayers.Storage attribute*), 50  
 thickness (*pyswmm.lidlayers.Surface attribute*), 51  
 to\_pervious (*pyswmm.lidgroups.LidUnit attribute*), 46  
 total\_inflow (*pyswmm.nodes.Node attribute*), 29  
 total\_outflow (*pyswmm.nodes.Node attribute*), 30  
 total\_precip (*pyswmm.raingages.RainGage attribute*), 56

## U

unit\_area (*pyswmm.lidgroups.LidUnit attribute*), 46  
 ups\_xsection\_area (*pyswmm.links.Link attribute*), 41  
 use() (*in module lib*), 66

## V

void\_fraction (*pyswmm.lidlayers.DrainMat attribute*), 48  
 void\_fraction (*pyswmm.lidlayers.Pavement attribute*), 49  
 void\_fraction (*pyswmm.lidlayers.Storage attribute*), 50  
 void\_fraction (*pyswmm.lidlayers.Surface attribute*), 51  
 volume (*pyswmm.links.Link attribute*), 42  
 volume (*pyswmm.nodes.Node attribute*), 30

## W

WaterBalance (*class in pyswmm.lidunits*), 54  
 width (*pyswmm.subcatchments.Subcatchment attribute*), 64  
 wilting\_point (*pyswmm.lidlayers.Soil attribute*), 50