

# WATER

**Storm Drainage System** - It's a network of structures, channels and underground pipes that carry stormwater (rain water) to ponds, lakes, streams and rivers. The network consists of both public and private systems.

**Sanitary Sewer System** - an underground pipe or tunnel system for transporting sewage from houses and commercial buildings (but not stormwater) to a sewage treatment plant or disposal. Sanitary sewers are a type of gravity sewer and are part of an overall system called a "sewage system" or sewerage. Sanitary sewers serving industrial areas may also carry industrial wastewater. In municipalities served by sanitary sewers, separate storm drains may convey surface runoff directly to surface waters. An advantage of sanitary sewer systems is that they avoid combined sewer overflows. Sanitary sewers are typically much smaller in diameter than combined sewers which also transport urban runoff. Backups of raw sewage can occur if excessive stormwater inflow or groundwater infiltration occurs due to leaking joints, defective pipes etc. in aging infrastructure.

**Wastewater Treatment Plant** - a process used to remove contaminants from wastewater and convert it into an effluent that can be returned to the water cycle. Once returned to the water cycle, the effluent creates an acceptable impact on the environment or is reused for various purposes (called water reclamation). The treatment process takes place in a wastewater treatment plant. There are several kinds of wastewater which are treated at the appropriate type of wastewater treatment plant. For domestic wastewater (also called municipal wastewater or sewage), the treatment plant is called a sewage treatment plant. For industrial wastewater, treatment either takes place in a separate industrial wastewater treatment plant, or in a sewage treatment plant (usually after some form of pre-treatment). Further types of wastewater treatment plants include agricultural wastewater treatment plants and leachate treatment plants.

**Domestic Water** - water used for indoor and outdoor household purposes— all the things you do at home: drinking, preparing food, bathing, washing clothes and dishes, brushing your teeth, watering the garden, and even washing the dog.

**Stormwater** - also spelled storm water, is water that originates from precipitation (storm), including heavy rain and meltwater from hail and snow. Stormwater can soak into the soil (infiltrate) and become groundwater, be stored on depressed land surface in ponds and puddles, evaporate back into the atmosphere, or contribute to surface runoff. Most runoff is conveyed directly as surface water to nearby streams, rivers or other large water bodies (wetlands, lakes and oceans) without treatment.

**Greywater** - (or gray water, sullage, also spelled gray water in the United States) refers to domestic wastewater generated in households or office buildings from streams without fecal contamination, i.e., all streams except for the wastewater from toilets. Sources of greywater include sinks, showers, baths, washing machines or dishwashers. As greywater contains fewer

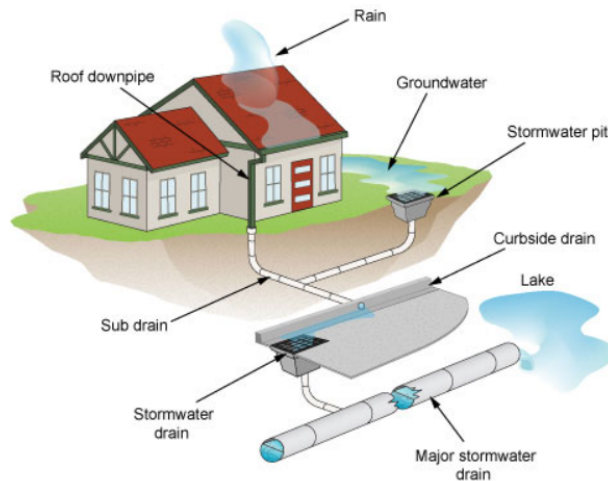
pathogens than domestic wastewater, it is generally safer to handle and easier to treat and reuse onsite for toilet flushing, landscape or crop irrigation, and other non-potable uses.

**Blackwater** - wastewater from toilets, which likely contains pathogens which may spread by the fecal–oral route. Blackwater can contain feces, urine, water and toilet paper from flush toilets.

**Pathogens** - bacteria, viruses, or other microorganisms that can cause disease.

<https://www.fairfaxcounty.gov/publicworks/stormwater/storm-drainage-system>

# STORMWATER SYSTEM - STREET DRAINAGE SYSTEM



[https://emedia.rmit.edu.au/dlsweb/Toolbox/plumbing/toolbox12\\_01/units/cpcpdr4002a\\_stormwater/00\\_groundwork/images/page\\_000\\_stormwater\\_collection.jpg](https://emedia.rmit.edu.au/dlsweb/Toolbox/plumbing/toolbox12_01/units/cpcpdr4002a_stormwater/00_groundwork/images/page_000_stormwater_collection.jpg)

**Roof downpipe** - A rainwater downpipe is a pipe that is used to direct rainwater away from a building, typically from roof guttering to a drainage system. It is sometimes also referred to as a downspout, drain spout, roof drain pipe or leader.

**Stormwater pit** - A stormwater pit is a reinforced concrete chamber constructed below ground, designed to accept rainwater from surface inlets and/or one or more upstream stormwater pipes and to discharge this rainwater into a single downstream stormwater pipe.

**Stormwater drain** - (storm drain, storm sewer, inlet, grate on edge of road) - infrastructure designed to drain excess rain and ground water from impervious surfaces such as paved streets, car parks, parking lots, footpaths, sidewalks, and roofs. Storm drains vary in design from small residential dry wells to large municipal systems.

**Curbside drain** - A curb is a barricade between the yard and the street or pathway/walkway. On the curb is a gutter that directs water away from the yard and into the street's drainage system. Curbs and gutters are constructed together for efficiency.

**Sub drain** - Subsurface drainage is a pipe installed beneath the ground surface to collect and/or convey excess water. Sizing varies depending on the location.

**Major stormwater drain** - (closed storm drain, underground) a channel or pipe used to carry off rainwater. The term could be used for drains at a home or businesses as well as for the pipes that are part of a city's drainage system.

**Catch basin** - A catch basin has a grate on top and a drainage pipe that slopes away from the basin. This box is set into the ground at a low point on the property. Catch basins help maintain proper drainage and catch debris, which helps prevent pipes downstream from becoming clogged. Water and solids enter the box through the grate.

Open ditch drainage components

**Culvert** - A culvert is a structure that channels water past an obstacle or to channel a subterranean waterway. Typically embedded so as to be surrounded by soil, a culvert may be made from a pipe, reinforced concrete or other material.

**Roadside Drainage Ditch** (Two-stage drainage ditch) - A drainage ditch is a depression in the land created to channel water. Drainage ditches are typically formed around low-lying areas, roadsides or fields proximate to a water body or created to channel water from a more distant water source for the purpose of plant irrigation. The two stage drainage ditch is classified as a 'surface' sustainable drainage system, contrary to a sub-surface system.

Some objects might have several names.

<http://lgam.wikidot.com/stormwater-pit>

<https://southcoastpaving.com/curb-and-gutter-ultimate-guide/>

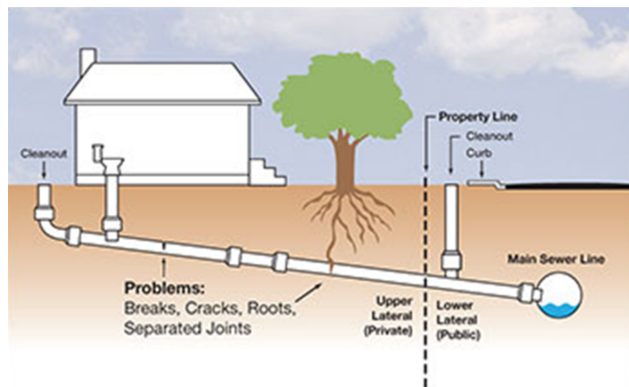
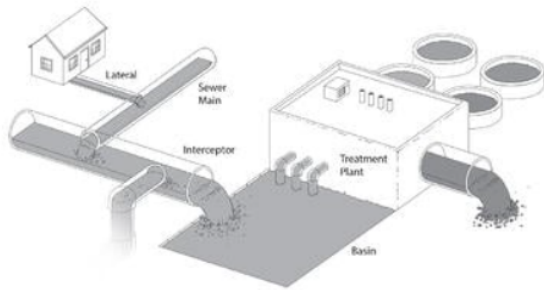
[https://en.wikipedia.org/wiki/Storm\\_drain](https://en.wikipedia.org/wiki/Storm_drain)

<https://en.wikipedia.org/wiki/Culvert>

[https://en.wikipedia.org/wiki/Two-stage\\_drainage\\_ditch](https://en.wikipedia.org/wiki/Two-stage_drainage_ditch)



# SANITARY SEWER SYSTEM



<https://blog.envirosight.com/sewer-school-how-does-a-sewer-force-main-work>

**Sanitary Sewer Overflow (SSO)** - a backup of raw wastewater that can contaminate our water, causing property damage, and threatening public health.

**Upper Lateral** - A sewer lateral is the pipe that conveys sewage from a building's plumbing to the City sewer system. The property owner handles the maintenance and replacement of the upper sewer lateral only – the part on private property.

**Lower Lateral** - A sewer lateral is the pipe that conveys sewage from a building's plumbing to the City sewer system. The City handles the lower sewer lateral, which is the part from the property line to the sewer main.

**Cleanout** - The sewer clean out is a pipe or pipe(s) with a cap that provides access to the sewer line so that blockages can be removed. The lateral sewer line is the sewer line that connects your home to the main public sewer system. Usually, the sewer cleanout is located somewhere along the lateral sewer line.

**Lateral Pipe** - Wastewater initially travels through a lateral pipe on an individual property before combining with the wastewater of neighboring properties in the sewer main located under a nearby street.

**Gravity Sewer / Gravity Lines** - The primary force pushing the wastewater from its place of origin to its final location for treatment is gravity. That means no mechanical or power sources are required to move the wastewater along.

**Force Mains** - Force mains rely on mechanical pumps or compressors located in a lift station to create the pressure to drive the wastewater up to higher elevations. This provides a solution for regions where the topography can't support a gravity-reliant system, ensuring the wastewater still gets where it needs to go.

**Lift Station** - A wastewater lift station is a pumping station that moves wastewater from a lower elevation to a higher elevation. The benefit of using a lift station in a sewage collection system is that it saves a substantial amount of money in excavation costs, which involves digging for sewer pipes. Sewer pipes live underground, and digging trenches is costly. Installing a wastewater lift station at certain points in a gravity pipeline system saves on front-end construction costs without sacrificing efficiency or functionality. They play an integral role in moving sewage to a wastewater treatment plant. (<https://htt.io/resources/lift-station-basics/>)

**Sewer Cleanout** - The sewer clean out is a pipe or pipe(s) with a cap that provides access to the sewer line so that blockages can be removed. The lateral sewer line is the sewer line that connects your home to the main public sewer system. Usually, the sewer cleanout is located somewhere along the lateral sewer line.

(<https://augerpros.com/what-are-sewer-cleanouts-and-how-to-locate-them/>)

**Manhole** - A manhole (utility hole, maintenance hole, or sewer hole) is an opening to a confined space such as a shaft, utility vault, or large vessel. Manholes are often used as an access point for an underground public utility, allowing inspection, maintenance, and system upgrades. The majority of underground services have manholes, including water, sewers, telephone, electricity, storm drains, district heating, and gas.

**Grease Trap** - (also known as grease interceptor, grease recovery device, grease capsule and grease converter) is a plumbing device (a type of trap) designed to intercept most greases and solids before they enter a wastewater disposal system. Common wastewater contains small amounts of oils which enter into septic tanks and treatment facilities to form a floating scum layer. This scum layer is very slowly digested and broken down by microorganisms in the anaerobic digestion process. Large amounts of oil from food preparation in restaurants can overwhelm a septic tank or treatment facility, causing the release of untreated sewage into the environment. High-viscosity fats and cooking grease such as lard solidify when cooled, and can combine with other disposed solids to block drain pipes.

<https://www.alamedaca.gov/Departments/Public-Works-Department/Private-Sewer-Lateral>

## **LARGER SCALE(NEED BETTER NAME) - HCFCD?**

**Stormwater Detention (Basin)** - A detention, or dry, pond has an orifice level at the bottom of the basin and does not have a permanent pool of water. All the water runs out between storms and it usually remains dry. The system works by allowing a large collection area, or basin, for the water. The water then slowly drains out through the outlet at the bottom of the structure. Sometimes concrete blocks and other structures act as a deterrent to slow the water flow and collect extra debris.

**Retention Basin or Pond** - A retention basin or pond has a riser and orifice at a higher point and therefore retains a permanent pool of water. A retention pond looks like a regular pond, but plays an important role in controlling stormwater runoff. Water is diverted to a wet retention pond by a network of underground pipes connecting storm drains to the pond. The system allows for large amounts of water to enter the pond, and the outlet lets out small amounts of water as needed to maintain the desired water level.

**Bypass Channel** - Bypass channels divert river flows from a point upstream of an area requiring protection. These diverted flows can be discharged back to the same river, herein referred to as a bypass channel or into another natural drainage system nearby, herein referred to as a diversion channel. Gates regulate flow into bypass and diversion channels. Functioning of a bypass channel depends mainly on its location, length, carrying capacity and inlet characteristics. While a bypass channel reduces flood magnitude in the bypassed area, it may increase flooding farther downstream, as floodwaters are rushed through the bypass channel. A diversion channel can increase the possibility of flooding in the receiving drainage system downstream if the diverted flows are larger than its carrying capacity. Detention or retention basins, constructed in conjunction with the bypass system, can avoid such situations.

**Levee** - A levee, dike, dyke, embankment, floodbank, or stop bank is a structure that is usually earthen and that often runs parallel to the course of a river in its floodplain or along low-lying coastlines. The purpose of a levee is to keep the course of rivers from changing and to protect against flooding of the area adjoining the river or coast. Levees can be naturally occurring ridge structures that form next to the bank of a river, or be an artificially constructed fill or wall that regulates water levels.

**Watershed** - geographical regions of land or drainage areas that drain rainfall runoff or stormwater into a common body of water, mostly creeks and bayous in Harris County.

**Bayou Drainage** - Drainage of the land can occur directly into a Bayou or a Creek or through a series of systems that may include storm sewers, roadside ditches, and or tributary channels.

**Creeks** - a stream, brook, or minor tributary of a river.

**Tributaries** - A tributary, or affluent, is a stream or river that flows into a larger stream or main stem (or parent) river or a lake. A tributary does not flow directly into a sea or ocean. Tributaries and the main stem river drain the surrounding drainage basin of its surface water and groundwater, leading the water out into an ocean. The opposite to a tributary is a distributary, a river or stream that branches off from and flows away from the mainstream. Distributaries are most often found in river deltas.

**River Delta** - A river delta is a landform shaped like a triangle, created by deposition of sediment that is carried by a river and enters slower-moving or stagnant water. This occurs where a river enters an ocean, sea, estuary, lake, reservoir, or (more rarely) another river that cannot carry away the supplied sediment. It is so named because its triangle shape resembles the Greek letter Delta. The size and shape of a delta is controlled by the balance between watershed processes that supply sediment, and receiving basin processes that redistribute, sequester, and export that sediment. The size, geometry, and location of the receiving basin also plays an important role in delta evolution. River deltas are important in human civilization, as they are major agricultural production centers and population centers. They can provide coastline defense and can impact drinking water supply. They are also ecologically important, with different species' assemblages depending on their landscape position.

**Estuary** - An estuary is a partially enclosed, coastal water body where freshwater from rivers and streams mixes with salt water from the ocean. Estuaries, and their surrounding lands, are places of transition from land to sea.

**Galveston Bay** - A bay in the western Gulf of Mexico along the upper coast of Texas. It is the seventh-largest estuary in the United States,<sup>[2]</sup> and the largest of seven major estuaries along the Texas Gulf Coast. It is connected to the Gulf of Mexico and is surrounded by sub-tropical marshes and prairies on the mainland.<sup>[3]</sup> The water in the bay is a complex mixture of sea water and fresh water, which supports a wide variety of marine life. With a maximum depth of about 10 feet (3 m) and an average depth of only 6 feet (2 m), it is unusually shallow for its size.

**Conveyance** - Water conveyance means a canal, ditch, pipeline, or other means of conveying water. From one place to another.

**Canal** - Canals or artificial waterways are waterways or engineered channels built for drainage management (e.g. flood control and irrigation) or for conveyancing water transport vehicles (e.g. water taxi). They carry free, calm surface flow under atmospheric pressure, and can be thought of as artificial rivers.

**Gully** - A landform created by running water, mass movement, or commonly a combination of both eroding sharply into soil or other relatively erodible material, typically on a hillside or in river floodplains or terraces. Gullies resemble large ditches or small valleys, but are meters to tens of meters in depth and width and are characterized by a distinct 'headscarp' or 'headwall' and progress by headward (i.e. upstream) erosion. Gullies are commonly related to intermittent or ephemeral water flow usually associated with localized intense or protracted rainfall events, or snowmelt.

Gullies can be formed and accelerated by cultivation practices on hillslopes (often gentle gradient) in farmland, and they can develop rapidly in rangelands from existing natural erosion forms subject to vegetative cover removal and livestock activity.

**Buffer** - A parcel or strip of land that is designed and designated to permanently remain vegetated in an undisturbed and natural condition to protect an adjacent aquatic or wetland site from upland impacts, to provide habitat for wildlife and to afford limited public access.

**Catchment** - An area which drains naturally to a particular point on a surface water body, thus contributing to its natural discharge.

**Drainage Basin** - Total area drained by a stream and its tributaries.

**Runoff** - Generally refers to surface flows generated by impervious surfaces.

**Run-on** - Generally refers to water entering a property from an off-site source.

**Runoff-water** - refers to the flow of water after a stormwater, or other source. It occurs because the soil is saturated, it's at full capacity of water absorption and the soil drains the excess. That's why it is the first, because it is the smallest among the options.

**Rill** - Refers to a superficial channel cut into soil caused by soil erosion, it doesn't have too much depth (a few centimeters), so it cannot have a great amount of water, just more than a runoff-water. A rill is like cracks in the soil.

**Gully** - is when running water erodes the soil, creating a landform, it typically occurs in hills, there it's created easier. Gullies can create ditches or small valleys, that's why it has to have the third place.

**Stream** - A small river, it's a surface water that flows into a channel. Basically, streams are the result of geological and hydrological factors, they are part of the water cycle.

**Tributary** (or affluent) - A river that flows into a lake or other mainstream rivers, but it doesn't flow into the sea, that's the difference. A tributary is also called an affluent. So, the main characteristic is that it flows into lakes or bigger streams, the opposite is a distributary, which flows away from main streams, that is, in the opposite direction of tributaries.

**River** - A natural flowing water which can flow towards lakes, oceans, seas or other mainstream rivers. The difference with tributaries is that rivers flow into seas or oceans, and they can have a bigger mass of water.

*“Therefore, the right order according to size is: Runoff, rill, gully, stream, tributary, and river.”*

<https://www.hcfcd.org/About/Flooding-and-Floodplains/Drainage-Network>

<https://en.wikipedia.org/wiki/Levee>

<https://info.wesslerengineering.com/blog/stormwater-basins-detention-retention-ponds#:~:text=A%20detention%2C%20or%20dry%2C%20pond,a%20permanent%20pool%20of%20water.>

[https://www.geo.fu-berlin.de/en/v/iwrm/Implementation/technical\\_measures/Flood-protection-measures/structural\\_measures/bypass\\_diversion\\_channels/index.html](https://www.geo.fu-berlin.de/en/v/iwrm/Implementation/technical_measures/Flood-protection-measures/structural_measures/bypass_diversion_channels/index.html)

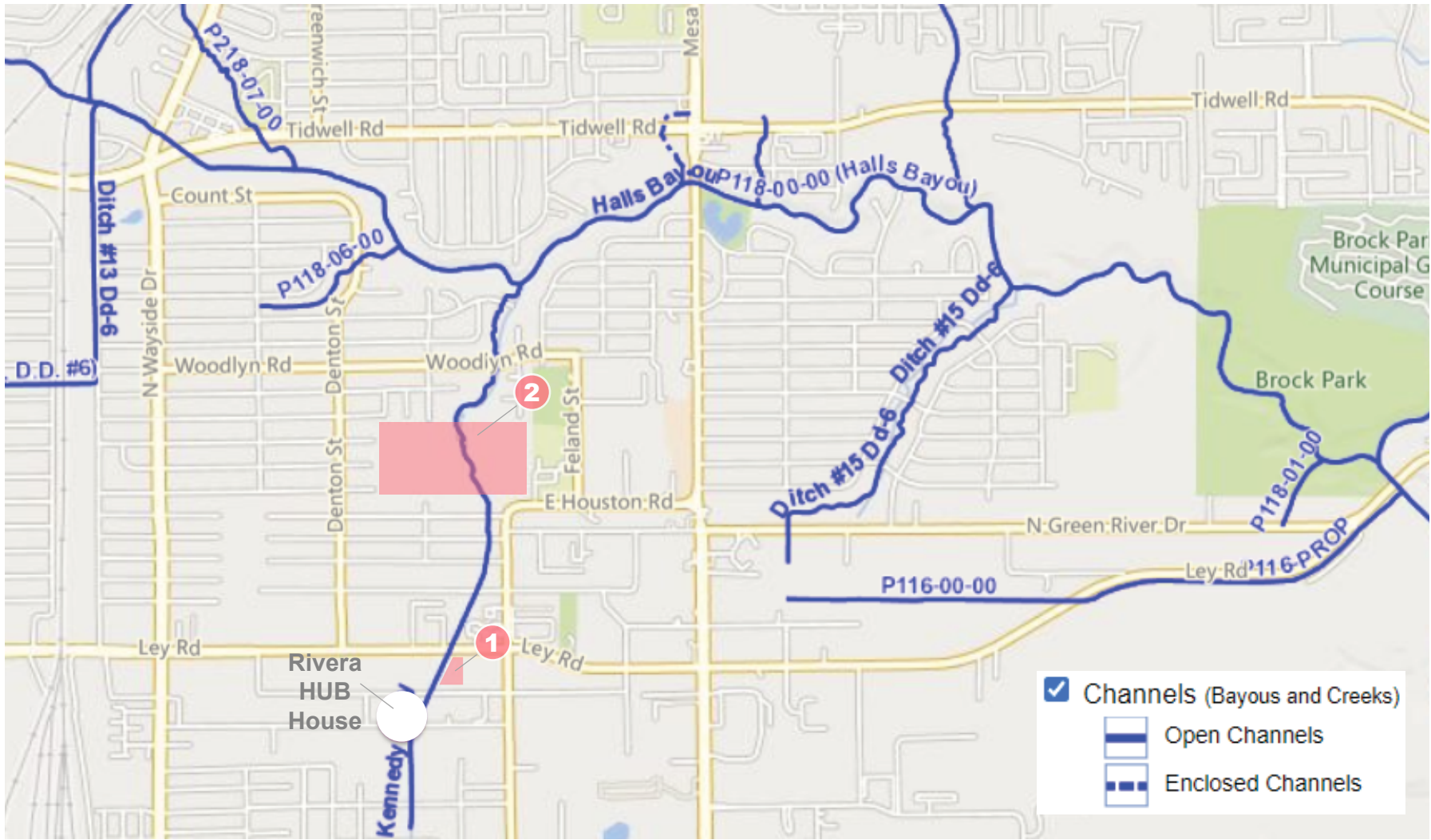
<https://en.wikipedia.org/wiki/Tributary>

[https://en.wikipedia.org/wiki/River\\_delta](https://en.wikipedia.org/wiki/River_delta)

[https://en.wikipedia.org/wiki/Galveston\\_Bay](https://en.wikipedia.org/wiki/Galveston_Bay)

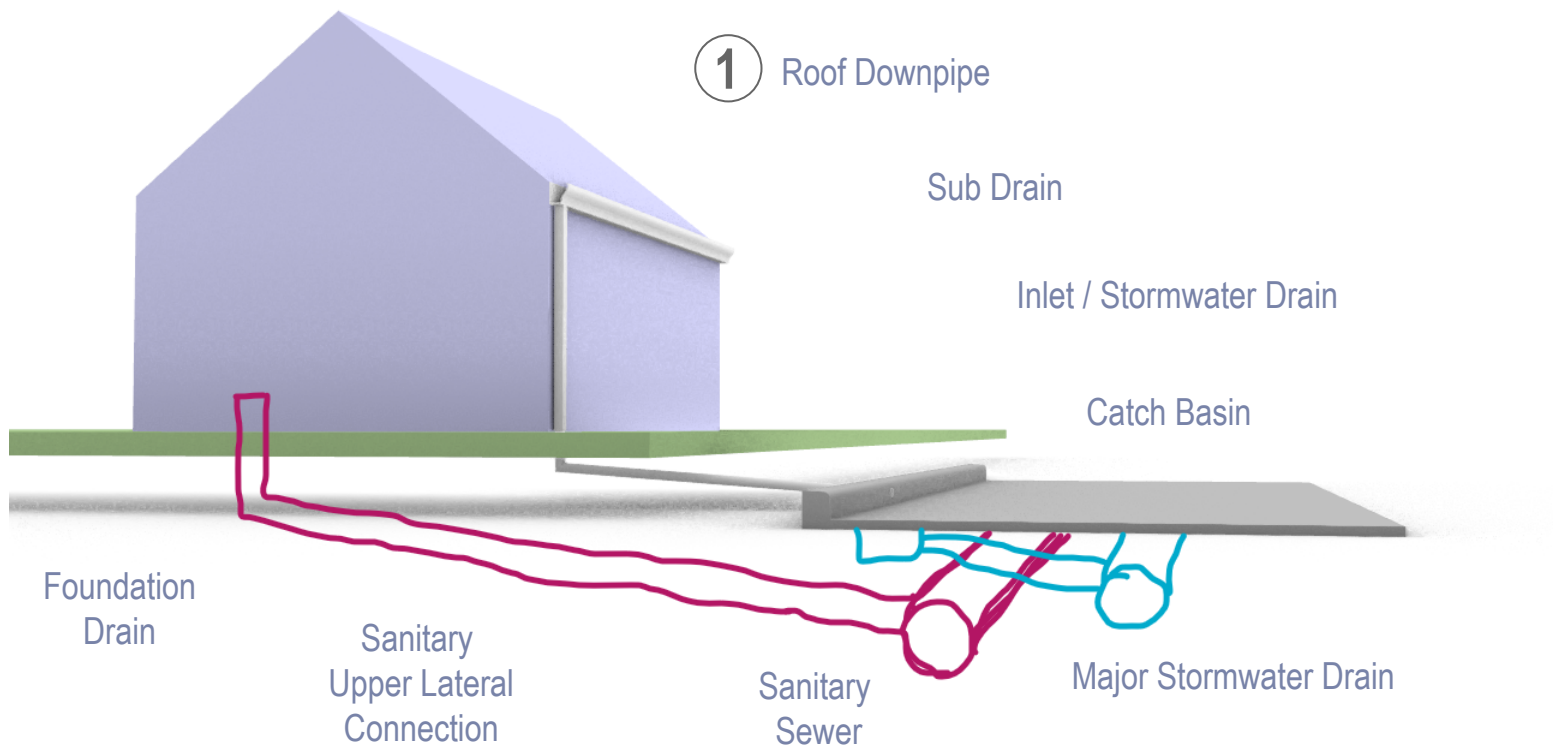
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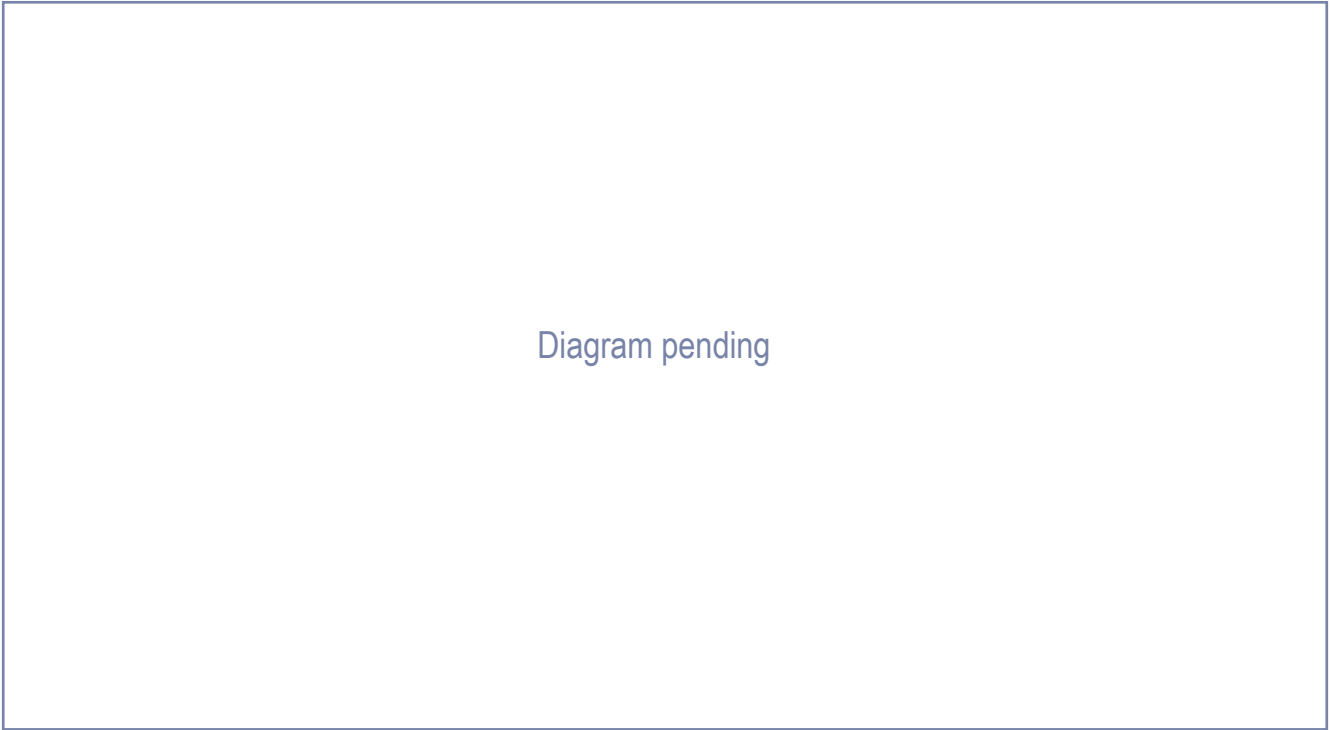




# Underground Stormwater System



# Open Ditch Stormwater System



# Sanitary Sewer System

