Utility Drawings 101: The Plan and Profile

Executive Summary. Learn the basics of how to read a utility plan and profile. One thing is consistent: no drawings are the same. You'll learn enough here to talk intelligently.

Utilities as a component of the site plan. Drawings used to construct the civil component of a project usually include the following types of drawings: the general, survey, demolition, grading, and utility drawings. Each of these components of the drawing package must be constructed by the general contractor. The other disciplines (i.e. architectural, mechanical, electrical, et cetera) are used in conjunction with the civil drawings. The contractor has to figure out in which order the drawings will be constructed.

The plan and profile drawings. The three main civil utilities are drain, sewer, and water (these are called "wet" utilities). They go by other names too such as storm, sanitary, and fire (for fire suppression lines), respectively. They are shown to the Contractor by the Engineer in a *plan view* (this is the view as looking from the sky down on the project) and the *profile view* (this is a sideways view as if the earth was cut vertically above the centerline of the pipe and its manholes/inlets).

The plan view (looking from above). At the top of the next sheet is an excerpt of a drain line construction project on Maui. Notice the title of the sheet is "UTILITY *PLAN*". The orange solid circle is a drain inlet, the black line "D24"" indicates the drainline and its diameter, the green highlight shows a concrete jacket to be constructed around a sewer line, and the yellow highlights show critical survey information. Reviewing the plan from top to bottom, find the following:

- "PAPA AVE. BASELINE" – this is an imaginary survey line established by the Engineer and, from this line, the Engineer has laid out the location of the drain inlets and pipe. It's called a "baseline" because usually there is another imaginary line set up somewhere in the drawing set by the Engineer to be used more locally for other utilities.
- "PAPA ℄ 133+01" – this indicates where along the PAPA baseline the drain inlet is located. The inlet is 13,301 feet from the start of the line.
- "STA. 0+50 PAPA AVE. D.L." – the baseline definition above talks about the use of local survey. This station number, 0+50, is a local survey line created solely the Engineer to layout this drain line. This drain inlet is 50' from the start of the local survey line.

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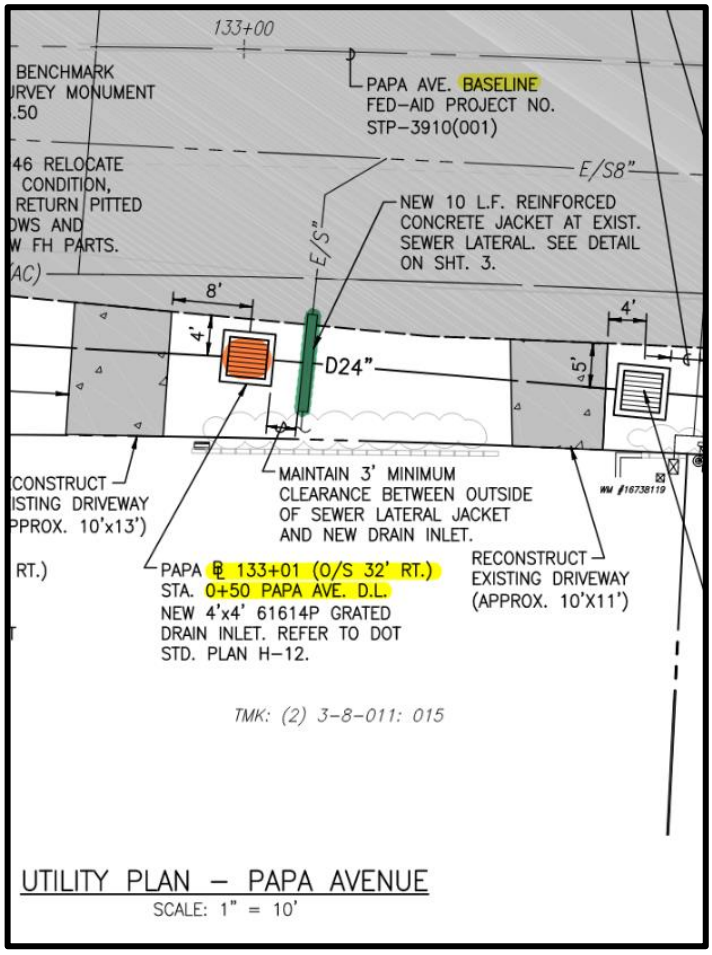
- "O/S 32' RT." – this stands for offset 32 feet to the right. This is a reference to the baseline. So, this inlet is 32' to the right (at a right angle) of the baseline as it counts up. It cannot be seen here, but to the right of Station 133+00, you would be able to see 134+00 (again, because the baseline is counting up as it travels to the right). The offset is to the right because as you would walk along the baseline from a lower station to a higher station, the drain inlet is on your right.
- "NEW 4'X4' 61614P GRATED DRAIN INLET" – this is the size and likely the model number of the inlet.
- "REFER TO DOT STD. PLAN H-12" – Reference to Hawaii Department of Transportation standard drawing H-12 for specifications and dimensions on what to build.



The profile view (looking at a vertical cut through the pipeline). The profile view is important because it shows you the cut depth of the pipe, any utility conflicts, and critical elevations. Notice again, the title of the sheet is DRAINLINE *PROFILE*.

As you can see on the next page the top of the grate inlet is shown in orange, the sewer crossing in green, and survey information shown in yellow. Reviewing the plan from top to bottom, find the following:

- "EXISTING GROUND AT PIPE" – this shows how deep the line is to be buried which helps the Engineer calculate the hydraulic characteristics of the utility line and the contractor estimate the cost of the line (since deeper is usually more expensive).

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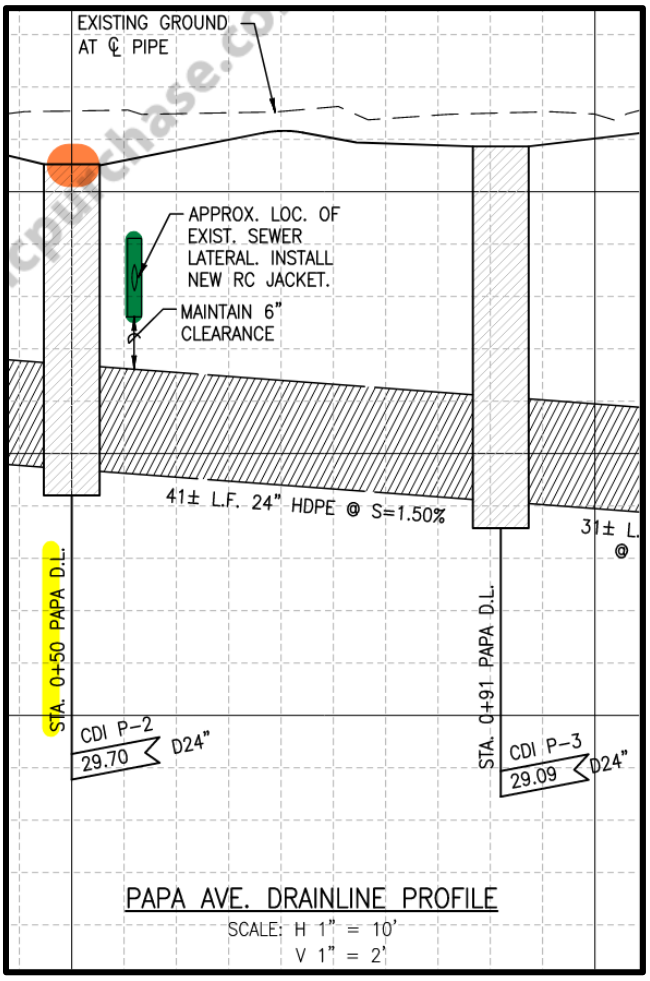
- "MAINTAIN 6" CLEARANCE" – clearances from adjacent utilities (water, sewer, gas, and electrical) are often shown.
- "41 ± L.F. 24" HDPE @ S=1.50%" – this shows the 24" diameter pipe run to be approximately 41 feet long, made of HDPE (high density polyethylene) and laid at a slope of 1.5%, or 1.5 feet of fall in 100 feet horizontally.
- "CDI P-2, 29.70" – CDI stands for concrete drain inlet and the structure has been numbered P-2 by the Engineer. This structure number will vary from project to project and Engineer to Engineer. The 29.70 is the invert elevation; the invert elevation (also shown as IE) is the elevation at which the bottom of the pipe enters the structure.
- "H 1" = 10'" – the H and the V stand for horizontal scale and vertical scale, respectively. On a full size sheet one inch as measured on the paper equates to either 10' or 2' out in the field. This is usually the only place in the drawing set where there exist two scales in one drawing.



What's not shown. As stated on the first page, all drawings vary. Things that can be seen on other drawings, not seen here, may include:

- IEs in and out – invert elevations in and out of the manholes or inlets; often they vary.
- Rim elevation – the elevation of the drain inlet grate at grade or the solid lid on a manhole
- Coordinates – the northing and easting of the inlet or manhole (a coordinate)
- Existing utilities – the profile above shows the sewer line; however, many utilities have many more utility crossings. The more utility crossings, the more expense the installation of the new line.

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- Hydraulic gradient line – an engineering characteristic of the water flow (used by the Engineer in design, not the Contractor).
- Groundwater table – the elevation at which groundwater was encountered in borings
- Rock – the elevation at which rock was encountered in borings

My story. I took this drawing from a blueprint class I taught. This is a very simple plan and profile. But, like anything else, if you can master the basics you'll have the tools you need to accomplish more complex tasks.

As practice, you can always check the math on these drawings. For example, look at the starting and ending point of a pipe run and see if it is falling at 1.5' per 100' like it says. Bust out the $5 Casio and try it.

Lastly, the difference between drain and sanitary sewer line drawings is not great. However, you will notice on water lines that there are many more appurtenances and labels: fittings, couplings, air relief valves, pressure reducing valves, just a plethora of special items.

Work safe!

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