Landscape Lighting Plan

Step 1 - Planning

- **What is the goal:** aesthetics, safety, security, or a combination
- **What are you illuminating :** pathways, entries, trees, walls, hardscapes, objects, water features
- **Priority areas:** essential vs optional
- **Accessibility and distance** from power source to fixtures

Good lighting enhances a space without overpowering. The goal is balance, not brightness.

Step 2 - System Components

Low voltage (12V/ 24V) systems are made up of:

- Fixtures / LEDs
- Power supply
- Cables
- Supporting accessories

Selecting the right components from the start ensures safe operation, reliable performance, and long-term flexibility.

Fixtures

Fixtures should be chosen based on what you want to illuminate, not just how they look.
When selecting fixtures, consider:

- **Application** – path, accent, wall wash, hardscape, step, or downlighting
- **Wattage** – enough output to highlight features without over-lighting
- **Beam angle** – narrow beams for focal points, wider beams for coverage
- **Color temperature (Kelvin)** – warmer tones for ambiance, cooler tones for clarity and security

Each fixture should serve a specific purpose. More fixtures do not always mean better lighting.

Power Supply

The power supply converts line voltage to low voltage mode and determines how efficiently and consistently your system operates.

- **AC (Alternating Current)** – most simplistic and economic
- **DC (Direct Current)** – preferred for longer LED lifespan, and smooth, flicker-free dimming
- **Solar / RUPS (Renewable Universal Power Supply)** – off grid solar powering ideal for remote or hard-to-reach locations

Note: always plan for future expansion and avoid operating above 80% of power supply total capacity.

VA (Volt-Amps) & W (Wattage)

LED fixtures are rated using two values:

- **Wattage (W)** is the energy consumed by the LED and is used to estimate energy usage.
- **Volt-Amps (VA)** is the power required from the power supply.

The total system wattage and distance from power supply determines the VA required.

Cable

Cable is the backbone of the system and plays a major role in preventing voltage drop.

- Use weatherproof low-voltage wire rated for outdoor use
- Minimum recommended size: 14 AWG
- Bury cable at least 4 inches underground
- Use conduit in transition areas to prevent accidental damage
- Leave approximately 2 feet of extra cable at each fixture to allow for future repositioning

Choosing the correct cable size and allowing for flexibility upfront will save time and rework later.

Step 3 - Layout & Power Distribution

The layout defines how power is distributed from the power supply to each fixture and how electrical load is shared across the system.
A well-designed layout:

- Distributes power evenly
- Supports consistent light output
- Adapts to distance and site constraints

Common layout types:

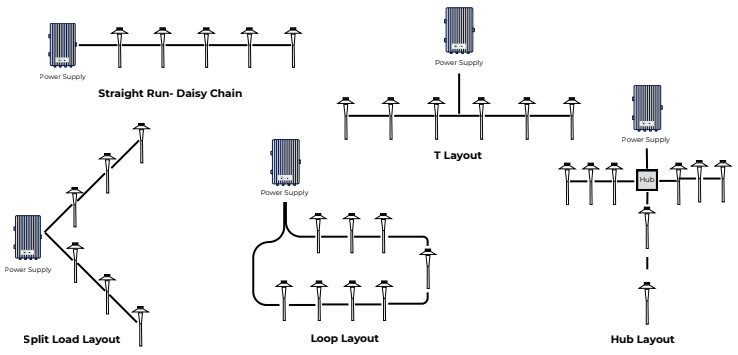
Straight Run (Daisy Chain): one continuous wire connects from the transformer through each fixture in order.
Best for: short runs with a few lights close together.

T Layout: the main wire runs out from the transformer and splits into two directions, forming a "T."
Best for: runs that split in two directions from the transformer.

Split Load: multiple wire runs connect directly from the transformer to separate zones (front yard, backyard, pathway, etc.).
Best for: large properties or distinct areas needing separate runs.

Hub Layout: each fixture (or small group of fixtures) connects to a central hub, and that hub connects back to the transformer.
Best for: multiple fixtures in a compact area requiring balanced voltage.

Loop Layout: the cable runs from the transformer through the fixtures and then loops back to the transformer, creating two paths for power flow.
Best for: maintaining even brightness across multiple fixtures within a single zone minimizing voltage drop.



Landscape Lighting Plan (cont.)

Step 4 - Power Calculations

Power calculations ensure consistent voltage is delivered to every fixture. Without proper planning, voltage can decrease as it travels through the system — a condition known as **voltage drop.**

The calculations in this step are used to size power supplies, select wire gauges, and define run lengths that maintain uniform light output.

Check Cable Length + Wire Gauge

Cable size and run length directly affect voltage drop.

Use the **Maximum Cable Length per Total Fixture Load** table to confirm:

- appropriate wire gauge
- the run length is within the recommended range for the total load

MAXIMUM CABLE LENGTH PER TOTAL FIXTURE WATTS							
Cable Size	**50W**	**75W**	**100W**	**150W**	**200W**	**250W**	**300W**
14-2	190'	125'	95'	65'	50'	-	-
12-2	300'	200'	150'	100'	75'	60'	-
10-2	475'	318'	240'	160'	120'	100'	80'

Cable Constant

Voltage drop is calculated using a cable constant based on wire size. The results of this value confirms that the selected cable and run length remain within acceptable limits.

CABLE CONSTANT	
Cable	**Constant**
18 AWG	1,380v
16AWG	2,200v
14AWG	3,500v
12AWG	7,500v
10AWG	11,920v
8AWG	18,960v

NOTE: Larger wires have lower AWG sizes.

Calculating Voltage Drop

Example
A run with 75W of load and 125 ft of cable using 12 AWG wire.

$$\textbf{VOLTAGE DROP} = \frac{\text{Total Watts/VA x Cable Length}}{\text{Cable Constant}} \times 2$$

EXAMPLE:

$$\textbf{VOLTAGE DROP} = \frac{\text{75W x 125'}}{\text{7500 (12 AWG Cable Constant)}} \times 2 = \textbf{2.5 volts}$$

Subtract the voltage drop from the power supply output to determine the actual voltage at the farthest fixture.

Recommended Voltage Range

For optimal performance, voltage at the fixture should typically remain between **10.8V and 15V.**

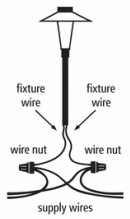
If voltage falls below this range, fixture output and performance may be affected.

If Voltage Drop Is Too High

- Split the run into multiple runs or zones
- Use a heavier gauge cable
- Shorten cable length
- Add an additional transformer
- Use a “LOOP” layout

Step 5 - Connecting your Fixtures

Connect each fixture to the main cable using waterproof connectors. Low-voltage systems are not polarity-sensitive, so wire orientation does not matter. Leave excess cable at each fixture to allow for future adjustments.



Step 6 - Testing & Final Adjustments

- Turn on the power supply and verify voltage at each fixture.
- Confirm consistent light output across the system
- Aim and adjust fixtures after sunset.