At a glance

- The Pilbara climate can suit irrigated fodder crops but may be challenging for other crop types
- Ascertain water quality, availability and reliability of supply to determine the potential area of irrigation
- Select good soils with the capability to store adequate plant available water between irrigation events
- Suitable soils close to the water supply will minimise expensive water transmission costs

Climate suitability for irrigated cropping

The Pilbara winter is generally dry with only western parts of the region receiving a small influence from south western frontal systems.

Average rainfall in the Pilbara ranges from 250 millimetres (mm), in the south west up to 350mm in the north east. Elevated areas in the Hamersley Ranges average more than 500mm. In the very hot summer months, highly variable rainfall is countered by high evaporation.

Summer and early autumn average daily temperatures exceed 30°C across the region, with average daily maxima exceeding 35°C from October to March. In northern inland areas, such as Marble Bar, average maxima exceed 40°C during summer and temperatures exceeding 45°C are common (Figure 1).

During the winter months, average temperatures are around 20°C across the region. Coastal areas have a lower annual temperature range compared to inland areas and winter temperatures rarely drop below 10°C. There is minimal risk of frost across the region, except for the upland areas of the Hamersley Ranges and far south-eastern Pilbara.
Hot, dry and sunny conditions mean the Pilbara is subject to very high evaporative demand. Over much of the Pilbara, point potential evaporation exceeds 3000mm per year. Potential evaporation is greatest during the summer months averaging 10–14mm per day and least during winter averaging 4–7mm per day.

The climate regime of the Pilbara whereby potential evapotranspiration greatly exceeds rainfall (Figure 2) means dryland cropping is likely to be unviable across the region.

Irrigation will be essential for commercial yields of fodder, grains, fibre or horticultural crops. The unique climate characteristics of the inland and elevated parts of the Pilbara may provide enough chill unit accumulation to enable the production of crops that have a level of vernalisation requirement.

Rates of solar radiation in the Pilbara are among the highest in Australia, indicating the potential for high rates of plant growth. Commercial horticultural crops are untested in the region, however it is likely that horticulturalists will need to consider strategies for certain crops to mitigate high temperature and low humidity extremes.

**Irrigation water quality**

Good quality irrigation water is essential to avoid crop yield reduction or long term salt accumulation in soil. Crop species will respond differently to the elevated salt content in irrigation water. Generally, there is little risk to crops or soil when using irrigation water of less than 440 milligrams per litre (mg/L) total dissolved solids (TDS). At levels above this, crops will increasingly exhibit yield penalties and management strategies will be required to prevent accumulation of salts in the soil.

Water quality at existing irrigation sites in the Pilbara are all considered fresh to slightly salty (less than 1000mg/L TDS) and would be suitable for a wide range of crops.

Prospective irrigators should undertake thorough chemical analysis of available water resources to determine the suitability for irrigation. A chemical analysis will not only highlight the salinity of the irrigation water but potentially elevated levels of specific minerals which could impact on crop production.

![Figure 2] Comparison of monthly rainfall to potential evapotranspiration for Marble Bar
Water supply

In the Pilbara water for irrigation has been sourced from the West Canning Basin, an artesian supply that delivers water to the surface under pressure. This source although relatively expensive to drill and access, is offset by having no requirement to pump water through the irrigation system. The West Canning Basin is confined to the north east Pilbara.

Elsewhere alluvial aquifers along rivers and streams have been tapped to supply irrigation water. In these locations water tends to be closer to the surface and must be pumped at adequate pressure to drive irrigation systems. Economic modelling indicates total pumping heads above 30 meters (m) become marginal for fodder production systems.

On the Ashburton River installation of a low weir has created a managed aquifer recharge (MAR) system used to capture and store streamflow to provide a more reliable supply from the alluvial aquifer.

Surplus mine dewater has also been used for irrigation, however this type of supply is subject to mining operations. An irrigator with access to mine dewater surplus should use the resource as part of a conjunctive supply with groundwater or MAR to mitigate supply disruption to irrigation operations.

The Pilbara Hinterland Agricultural Development Initiative (PHADI) identified a number of areas of potential irrigation water supply. These are based on known groundwater aquifers, stream flow and mine dewater surplus discharge. Further validation is required to quantify the rate and total yield of supply from these potential resources.

Crop water requirements

Crop water requirements will vary throughout the year in response to evapotranspiration rate and stage of crop development.

Perennial grass pastures that are regularly grazed or cut for fodder can use up to 30 megalitres per hectare (ML/ha) per annum. Long-season annual crops grown over the warmer months (September to April) may use up to 20ML/ha. Temperate crops grown over the cooler months (May to August) will use around 4–6ML/ha.
The instantaneous water supply rate is important especially in the summer months when crop water demand is highest. A 38 hectare centre pivot irrigator requires up to 70 litres per second when operating and delivers around 5ML/day. In the summer months when crop evapotranspiration is highest this volume of water would need to be applied almost every day.

It is essential that adequate water supplies are available to see the crop through to maturity. A good understanding of the characteristics of the water resource used for irrigation is needed to ensure water supply meets crop demand. Understanding of aquifer total yield and supply rate will help determine the potential size of an irrigation development.

**Soils for irrigation**

Soil type requirements for fodder, grain and horticultural crops will vary depending on the species grown. Table 1 highlights characteristics of the soils most suitable for irrigation and suitability for annual and perennial species. It also considers the soil physical properties that permit the application and storage of irrigation water for a crop.

Plant available water capacity (PAWC) is the term given to the volume of water that can be stored in a particular soil type and crop. PAWC will be affected by the soil type and potential rooting depth of a specific crop as deeper rooting crops can access more water from the soil profile than shallow rooted crop species.

When irrigating, high PAWC soils are preferred as they will be deep and well-structured, will not limit root growth and will store enough moisture to avoid overly frequent irrigation.

Broadly mapped areas of soils suitable for irrigation in the Pilbara are shown in Figure 3. While this map can be used as a guide, prospective irrigators seeking to undertake a development should conduct soil surveys to confirm suitability of soils in the area of interest.

<table>
<thead>
<tr>
<th>WA soil group name</th>
<th>Surface texture (0-30cm)</th>
<th>Subsurface texture (30-80cm)</th>
<th>Subsoil texture (&gt;80cm)</th>
<th>Indicative maximum plant available water (PAWC) in top metre of soil</th>
<th>Estimated relative nutrient holding capacity (top 30cm)</th>
<th>Indicative soil depth — annual species</th>
<th>Indicative soil depth — perennial species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep sand</td>
<td>Sand</td>
<td>Sand</td>
<td>Sand – loam</td>
<td>63mm</td>
<td>Low</td>
<td>Deep</td>
<td>Deep</td>
</tr>
<tr>
<td>Sandy earth</td>
<td>Sand</td>
<td>Sand – loam</td>
<td>Loam</td>
<td>77mm</td>
<td>Moderate</td>
<td>Deep</td>
<td>Deep</td>
</tr>
<tr>
<td>Loamy earth</td>
<td>Loam</td>
<td>Loam</td>
<td>Loam – clay</td>
<td>85mm</td>
<td>High</td>
<td>Deep</td>
<td>Deep</td>
</tr>
<tr>
<td>Deep sandy duplex</td>
<td>Sand</td>
<td>Clay (by 80cm)</td>
<td>Clay</td>
<td>80mm</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Deep loamy duplex</td>
<td>Loam</td>
<td>Clay (by 80cm)</td>
<td>Clay</td>
<td>88mm</td>
<td>High</td>
<td>Moderate</td>
<td>Deep</td>
</tr>
</tbody>
</table>
Figure 3. Suitable soils for irrigation in the Pilbara
Find out more

Please visit the Department of Primary Industries and Regional Development website for more information on climate, land and water in the Pilbara or to download a copy of the report Growing the Pilbara.

Visit: www.dpird.wa.gov.au

Find contact details for your nearest DPIRD office below, or email enquiries@dpird.wa.gov.au

South Perth office
3 Baron-Hay Court, South Perth WA 6151
📞 +61 (0)8 9368 3333

Broome office
27 Hunter Street, Broome WA 6725
📞 +61 (0)8 9194 1400

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