

Appendix C

Flora and Vegetation Studies

Appendix C1 GDE Riparian Vegetation Investigation

Iron Valley Groundwater Dependent Ecosystem Investigation

December 2015

Prepared for
BC Iron Limited



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Iron Valley Groundwater Dependent Ecosystem Investigation

Prepared for
BC Iron Limited

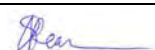
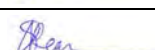
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Abbreviations

Abbreviation	Definition
AQ2	AQ2 Pty Ltd
AWT	Above watertable mining
BC Iron	BC Iron Limited
BHPBIO	BHP Billiton Iron Ore Limited
BWT	Below watertable mining
Consult.	Specialist GDV consultant
DBH	Diameter at Breast Height
Ec	<i>Eucalyptus camaldulensis</i>
Ev	<i>Eucalyptus victrix</i>
GDE	Groundwater Dependent Ecosystem
GDV	Groundwater Dependent Vegetation
GIS	Geographical Information System
GWI	Groundwater Impact
kL/d	Kilolitres per day
Ma	<i>Melaleuca argentea</i>
mbgl	Metres below ground level
MC	Marillana Creek
MRL	Mineral Resources Limited
MS	Ministerial Statement
NDVI	Normalised Difference Vegetation Index
NDWI	Normalised Difference Water Index
NIR	Near infrared spectral band
R	Red spectral band
Rio Tinto	Rio Tinto Iron Ore
SWI	Surface Water Impact
SWIR	Short wave infrared spectral band
The Project	The Iron Valley Above Watertable Mining Project
TSF	Tailings Storage Facility
VIS	Visible spectral band
WWC	Weeli Wolli Creek

Executive Summary

The Iron Valley mining project, located approximately 90 kilometres north-west of Newman in the Eastern Pilbara region, is an iron ore mine being developed by Mineral Resources Limited on behalf of BC Iron Limited. As the mine develops, there will be an expected change from mining above the water table to below the water table. Mining below the watertable will require groundwater abstraction for the purpose of mine dewatering and discharge of water into the nearby Weeli Wolli Creek. Groundwater abstraction has the potential to affect the health of groundwater dependent vegetation within a projected drawdown and mounding zone, which extends outwards from the mine to cover significant portions of the Marillana-Weeli Wolli Creek system. This report presents an investigation into the potential impact of groundwater abstraction and discharge on groundwater dependent vegetation near the Iron Valley mine, including a literature review, identification of the groundwater dependent vegetation risk area, risk assessment and consideration of monitoring requirements.

Groundwater dependent vegetation in the vicinity of the Iron Valley mine was identified using a combination of three different methods: visual inspection of aerial imagery, analysis of multispectral satellite (Landsat) imagery, and on-ground reconnaissance. The area targeted for assessment was a circular area with a radius of 10 kilometres, with the centre point located in the approximate centre of the tenement, encompassing the expected area of groundwater drawdown. On-ground reconnaissance was undertaken over a period of three days, from 22 to 24 November 2015. A total of 14 sites were inspected along a 25 kilometre length of the Marillana-Weeli Wolli Creek system, with sites located every 1.5 kilometres to 3 kilometres. Sites were described and rated for a range of qualitative parameters.

Results from on-ground reconnaissance were used to produce maps of groundwater dependent vegetation based on the presence of the key indicator species: the facultative phreatophytes *Eucalyptus victrix* and *Eucalyptus camaldulensis*, and the obligate phreatophyte *Melaleuca argentea*. Maps were cross-checked with aerial imagery and remote sensing maps indicating the likely presence of groundwater dependent vegetation based on the persistence of vegetation 'greenness' and 'wetness'.

A model was devised to assess the risk of a biologically significant decline in groundwater dependent tree health in response to groundwater abstraction and discharge associated with the Iron Valley mining operations. The model incorporated a surface water impact score based on the projected presence of surface water, and a groundwater impact score based on the projected magnitude of drawdown or final depth to the water table of mounding. The model was applied using the groundwater dependent vegetation risk area maps and the results of numerical groundwater and surface water modelling undertaken by AQ2 Pty Ltd. After tallying impact scores, mapped vegetation was assigned to one of four categories of risk: negligible (zero probability of decline), low (< 10% probability of decline), moderate (10% to 50% probability of decline) and high (50% to 100% probability of decline).

The risk model was applied to two scenarios: Iron Valley impacts from dewatering and surplus disposal (referred to as the Base Case), and Iron Valley impacts plus surplus disposal from the proposed expansion of a neighbouring iron ore mine operated by Rio Tinto Iron Ore Pty Ltd (referred to as the Rio Tinto Case). Both scenarios were assessed based on conditions at the end of the mining at Iron Valley in 2025.

The total area containing groundwater dependent vegetation was estimated to be 2,284 hectares within a total assessed area of 31,416 hectares (area within the circle of 10 kilometres from the centre of the tenement). Groundwater dependent vegetation was found to occur along the entire inspected length of the Marillana-Weeli Wolli Creek system, mostly along creek banks and in creek beds but also within floodplain areas up to 1.5 kilometres wide. Of note, compared to the drier

northern (downstream) portion of Weeli Wolli Creek, the southern (upstream) portion of the Marillana-Weeli Wolli Creek system was clearly affected by current discharge from nearby mines. Southern areas were wetter (with pooled and flowing water) and more highly productive, supporting wetland areas and dense stands of *E. victrix*, *E. camaldulensis* and *M. argentea* that are likely to be both discharge and groundwater dependent.

Excluding areas within the Iron Valley tenement boundary (which are likely to be cleared), the area of groundwater dependent vegetation included in the risk assessment was 2,542 hectares. For the Base Case, approximately one quarter of the risk area (591 hectares) was assessed to be at high risk. The high risk area for the Base Case was spread across the area of the main creek bed and across the entire width of the risk area in places from the current Rio Tinto discharge point to approximately six kilometres downstream of the Marillana-Weeli Wolli Creek confluence. High risk for the Base Case was associated with groundwater drawdown from the Iron Valley mine coupled with surface water impacts from the existing Rio Tinto discharge. Surface water impacts from the Iron Valley discharge were assessed to pose a moderate risk immediately downstream of the Iron Valley discharge points, with no risk beyond the projected Iron Valley wetting front where groundwater levels are projected to rise but the water table is expected to remain relatively deep. Similar to the Base Case, approximately one quarter of the risk area (583 hectares) was assessed to be at high risk for the Rio Tinto Case. High risk for the Rio Tinto Case was predominantly associated with the main creek bed from the Rio Tinto discharge point to around 14 kilometres from Marillana-Weeli Wolli Creek confluence, approximately two kilometres beyond the furthest Iron valley discharge point. In this case, high risk was associated with surface water impacts and groundwater mounding in areas where groundwater levels were projected to rise very near the surface.

With regard to cumulative impacts, it appears possible that current and future disposal of water from Rio Tinto's mining operations could mitigate potential negative impacts of drawdown from the Iron Valley Project along the southern (upstream) portion of the Weeli Wolli Creek system. However, the combined discharge from Rio Tinto and Iron Valley in this cumulative scenario may potentially lead to an additional discharge impact along the mid to northern (downstream) portion of the Creek, which could be either positive in some areas and negative in others depending on species, spatial distribution of vegetation in the creek bed and surrounding areas, and tolerance to inundation and waterlogging.

It is difficult to predict with any certainty the long term consequences and recovery potential of groundwater dependent vegetation once groundwater and surface water regimes have stabilised and are back under natural influences. According to AQ2's modelling, groundwater levels and Creek water levels are projected to recover to an equilibrium level relatively quickly (within 10 years) once abstraction and discharge have ceased. Individuals that may have become adapted to shallower groundwater levels, waterlogging or additional soil water in the unsaturated zone may struggle to re-adapt to natural regimes. Overall however, given the prevalence of groundwater dependent vegetation in the area and the apparent good health of upstream and downstream populations, recovery of the ecosystem is expected, particularly if management measures such as staged discharge reduction are implemented.

Given the presence of significant groundwater dependent vegetation in the vicinity of the Project area, it is expected that there will be a monitoring requirement associated with any future approval for groundwater abstraction associated with below water table mining. A potential monitoring program of the type that may be required to meet regulatory requirements was outlined, including suggested monitoring sites, parameters and methods. High resolution satellite image acquisition is also recommended for inclusion in the program.

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1 Introduction

1.1 Background

The Iron Valley Mining Project (the Project) is an iron ore mine located on the Iron Valley Mining tenement (M47/1439), located approximately 90 km north-west of Newman in the Eastern Pilbara region. The registered holder of the Iron Valley tenement is Iron Ore Holdings Ltd, which was recently acquired by BC Iron Limited (BC Iron). The mine is being developed by Mineral Resources Limited (MRL) on behalf of BC Iron. The Project is in the same region as a number of other operating iron ore mines, the closest of which is the Rio Tinto Iron Ore (Rio Tinto) Yandicoogina mine (5 km to the west). The Iron Valley tenement is adjacent to land held by Rio Tinto, BHP Billiton Iron Ore Limited (BHPBIO) and Fortescue Metals Group.

MRL currently holds a licence to abstract 720 mega litres/year of groundwater for mine use associated with the Iron Valley Above Water Table (AWT) Mining Project. Abstraction for AWT mining commenced during the latter half of 2013, and a zone of water table drawdown has been projected to extend outwards from the mine area as a result of abstraction. Water table drawdown may potentially affect the health of groundwater dependent ecosystems (GDEs) containing groundwater dependent vegetation (GDV) within the projected drawdown zone.

Condition 6 of Ministerial Statement (MS) 933 for the Project stipulates a requirement to manage GDEs. In particular, BC Iron must ensure that there are no long term impacts to the health and abundance of the facultative phreatophytic tree species *Eucalyptus victrix* outside the approved disturbance area (Condition 6-1). Annual monitoring is currently being undertaken to maintain compliance with MS 933. The objective of the current monitoring program is to detect impacts of abstraction associated with AWT mining.

As the mine develops, there will be an expected change to mining below the water table (BWT), which will require further abstraction of groundwater for the purpose of mine dewatering and the disposal of surplus water. BC Iron is therefore currently seeking approval for a revised combined project: the Iron Valley BWT Mining Project. The zone of water table drawdown associated with groundwater abstraction for BWT mining has been projected to expand significantly across a much broader area around the mine than for AWT mining, including significant portions of the Marillana-Weeli Wolli Creek system that are likely to support significant GDE communities. Surplus water from the Iron Valley mine is also likely to be discharged directly into the creek, which would add to current discharge into the creek from Yandicoogina mine operated by Rio Tinto. Further volumes of excess water would also be disposed into the creek system should Rio Tinto proceed with development of their Pocket and Billiard Mine.

Significant changes to the hydrological regime around the Project are likely, and it is recognised that a good understanding of the spatial extent of GDV and the risk to GDV health in response to groundwater drawdown and mounding and changes in surface water flow in the Marillana-Weeli Wolli Creek system is required to support the approval process for further groundwater abstraction associated with BWT mining.

1.2 Scope of Work

The scope of work was to complete a desktop investigation and ground based truthing on the potential impact of future groundwater drawdown and discharge on GDV associated with the Iron Valley Mine, including requirements for future monitoring. The major purpose of the investigation is to support BC Iron's application for approval to undertake groundwater abstraction for the purpose of BWT mining.

1.3 Objectives

The major objectives of the investigation were to:

- identify and classify potential GDV in the vicinity of the Project
- assess the potential risk to GDV from groundwater abstraction and discharge associated with BWT mining
- assess potential cumulative impacts of BWT mining in the context of existing and reasonably foreseeable iron ore mines upstream
- identify potentially suitable locations for future monitoring of GDV
- conduct on-ground reconnaissance with regard to the location of GDV and potential monitoring sites
- outline an appropriate GDV monitoring program for the Project.

1.4 This Report

This report outlines the background, methods and results of the investigation. For context, the report includes a brief literature review on GDV and its responses to changes in groundwater and surface water. Readers are referred to other reports for summaries of the environmental setting (Astron 2012), GDV monitoring history (Astron 2014) and the broader impacts of increased groundwater abstraction at Iron Valley (Soilwater Consultants 2015). Following the literature review and background information on groundwater and surface water management for the Iron Valley mine, the report is divided into sections detailing the identification and mapping of GDV, a risk assessment, and future monitoring requirements.

2 Literature Review

2.1 Groundwater Dependent Vegetation

GDV is defined as terrestrial vegetation that is dependent on the presence of groundwater to meet some or all of their water requirements such that vegetation community structure and function is maintained (Orellana et al. 2012). GDV may be dependent on either the surface expression or subsurface presence of groundwater (Eamus, Hatton, et al. 2006). Surface expressions of groundwater occur in the form of base-flow rivers, streams, creeks, springs and some floodplains where groundwater may soak below the surface and become available to plant roots. Subsurface groundwater is accessed by plants via the capillary fringe above the water table, that is, the interface between the unsaturated and saturated zones of the soil profile.

GDV species that utilise groundwater are referred to as phreatophytes, and they may be classified as either obligate or facultative phreatophytes depending on their level of dependence on groundwater.

Obligate phreatophytes are plants that are completely or highly dependent on groundwater. This dependence can be continual, seasonal or episodic. Obligate phreatophytes tend to be associated with surface expressions of groundwater rather than the subsurface presence of groundwater, and they are highly sensitive to large changes in groundwater regime and respond negatively to rapid groundwater drawdown.

Facultative phreatophytes are plants that can access groundwater but are not totally reliant on groundwater to sustain their water requirement. Rather, they utilise groundwater opportunistically, particularly during times of drought when moisture reserves in the unsaturated (vadose) zone of the soil profile become depleted. Facultative phreatophytes are generally associated with the subsurface presence of groundwater rather than surface water. Most facultative phreatophytes are large woody trees and shrubs with deep root systems capable of accessing the capillary fringe of the water table, which may occur at considerable depth within the profile.

GDV communities are commonly associated with the riparian zones and floodplains of ephemeral creeks and rivers in arid and semi-arid areas of Australia including the Pilbara. Vegetation in these areas is often broadly categorised as 'riparian vegetation', of which GDV species are an important subset. However, GDV species sometimes occur in other areas of the landscape, as dominant or minor elements of communities, depending on soil type, groundwater depth and species rooting depth.

2.2 Plant Responses to Groundwater Drawdown

The response of GDV to groundwater drawdown is incremental, as described below and summarised in Table 1.

In the initial stages of drawdown, plants begin to lose contact with groundwater and they become increasingly dependent on soil moisture stored in the unsaturated zone to meet their water requirement. Contact with groundwater may be completely lost if the water table is lowered beyond the root zone, leading to complete reliance on the unsaturated zone. Beyond this point, further drawdown has no effect on plants.

As the store of water in the unsaturated zone becomes depleted, plants initiate short-term adaptive physiological responses (within days to weeks) to conserve water, the most important of which is stomatal closure in leaves (Eamus, Hatton, et al. 2006). Stomatal closure occurs to prevent damage

to leaf tissues as a result of dehydration, and to prevent failure of the water transport system as a result of cavitation and embolism in xylem vessels (note: stomata are pores in the leaf surface that allow exchange of water vapour, oxygen, carbon dioxide and other gases between the leaf and the atmosphere; xylem vessels are specialised, pipe-like conduits that comprise a plant's water transport system). Stomatal closure restricts water loss but it also reduces the rate of carbon fixation, which in turn leads to a reduction in growth.

If water stress is prolonged, plants may begin to initiate adaptive structural responses (over weeks and months) in an attempt to maintain contact with existing water sources, to explore new sources, or to reduce whole-plant water use in line with reduced water availability. This may include root proliferation and/or the shedding of leaves.

When faced with severe depletion of water, plants keep stomata closed for longer and experience progressively lower xylem water potentials (indicative of water stress) that may approach threshold levels beyond which plant tissues may sustain irreversible damage and the water transport system may collapse, resulting in plant death. Plants suffering from severe water stress over a prolonged period tend to display leaf discolouration, wilting and curling, senescence of fine roots, substantial leaf shedding, branch death, and overall poor canopy condition. At the stand level, severe water stress manifests as reduced leaf area index and altered spectral signatures characterised by reduced 'greenness'.

Prolonged water stress reduces the ability of plants to reproduce and increases the mortality of mature plants, such that individuals begin to die off with no recruitment of new seedlings. Eventually, over many years to decades, original species are replaced by a new suite of species more suited to the drier hydrological regime, which can lead to a marked change in community structure and function.

The timing and magnitude of the events described in Table 1 is highly variable across space and time, and these events depend on the timing and magnitude of groundwater drawdown. It is necessary to note that when followed to the end, this sequence of events represents an extreme, worst-case scenario. At the less severe end of the continuum, a drop in the water table may only cause a structural change to facultative phreatophytic trees, such as reductions in height, leaf area and possibly stand density, but not permanent compositional change involving an irreversible loss of GDV and replacement by new species.

Table 1: Summary of incremental response of groundwater dependent vegetation to groundwater drawdown.

Phase	Change and response	Timing
Groundwater drawdown	Initial decline in water table level ↓	Groundwater drawdown begins
	Root growth to maintain contact with water table ↓	Within weeks and months
	Water table declines below the maximum root zone ↓	Within weeks to years ¹
Soil drying	Plant available soil water in the unsaturated zone becomes depleted ↓	Within weeks to years ²
	Plant water uptake threshold is exceeded ↓	
Plant response to soil drying	Physiological responses: • stomatal opening reduced • transpiration declines • carbon fixation declines • leaves wilt ↓	Within weeks
	Structural responses: • leaf area declines • branch dieback • root dieback/new growth ↓	Within months
	Plant growth declines ↓	Within months
	Plant recruitment declines ↓	Within a couple of years
	Plant mortality increases ↓	Within several years
	New species invade ↓	Within a decade
	New community structure and function becomes evident	Within several decades

1. Dependent on rate of drawdown and depth of root system.

2. Dependent on depth of unsaturated soil, antecedent soil moisture, replenishment by rainfall, root system extent, competition for soil moisture, and evaporative demand.

2.3 Plant Responses to Groundwater Mounding, Surface Water Inundation and Waterlogging

Negative impacts to GDV can arise as a result of groundwater rise (mounding) or surface water pooling. Groundwater mounding can have a potential negative impact on GDV in situations where the water table rises to such an extent that it envelops a large proportion of the root system. Similarly, negative impacts from surface water can arise where exposed roots and stems are inundated by flowing or pooled surface water and a large proportion of the root system is embedded in soil that has become super saturated (waterlogged), termed the hyporheic zone (the layer of sediment adjacent to a stream through which stream water readily exchanges). Effects are obviously compounded in situations where the hyporheic zone intersects with groundwater mounding because there is no possibility that waterlogged, poorly aerated soils can drain into unsaturated soil layers underneath.

Soil aeration is physiologically important to plants. Oxygen is a key component of a number of physiological processes that take place within the plant including respiration and photosynthesis. Unless there is a rapid exchange of gas between the soil and the air, the oxygen supply soon becomes limiting for plant growth. The rate of exchange between soil and aboveground air decreases with decreasing soil porosity and increasing water content. Flooding of the capillary pore spaces in soil is highly likely to result in roots suffering severe oxygen deficiency due to the fact that soil air is displaced by water. This has major consequences given that transport of oxygen to roots is about 300,000 times greater through air-filled pore spaces than when they are filled with water (Kramer and Boyer 1995). Flooding also forces roots to obtain most of their oxygen from the shoot by diffusion though via complex, tortuous, highly inefficient pathways.

Most woody plants are not adapted to complete immersion in hypoxic, waterlogged soil conditions for extended periods of time. Flooding injuries can have multiple causes and symptoms (Kramer and Boyer 1995), including but not limited to:

- wilting
- development of adventitious roots near the water line
- reduced growth causing epinasty (downward and outward bending of plant parts), leaf chlorosis, and in severe cases death
- disruption of root hormone production and transport to other parts of the plant
- disruption to nutrient metabolism
- disruption to the development of healthy plant tissues such as aerenchyma (air conducting tissues)
- stem hypertrophy (swelling of tissues)
- damage caused by exposure to toxic compounds that may accumulate in flooded soils, such as methane and sulfides
- greater susceptibility to root diseases (for example, *Phytophthora*).

In general, plants that develop adventitious roots can usually survive flooding better than those that do not. It is well known that trees and other plants growing in poorly drained soil often develop shallow root systems concentrated in the better aerated soil surface (Kramer and Boyer 1995), which can have consequences for facultative phreatophytic species that depend on the development of a deep root system for long term survival.

2.4 Major Influencing Factors

The response of GDV to changes in groundwater level and surface water dynamics is predominantly influenced by the following factors: the depth to groundwater, the rate and magnitude of groundwater level change, and exposure to surface water. These factors are discussed below.

2.4.1 Depth to groundwater

There is general acceptance that reliance of GDV on groundwater decreases with increasing depth to the water table (Department of Water 2009). This is based on the fundamental empirical observation of plant growth that root biomass decreases exponentially with increasing depth (Jackson et al. 1996) such that most GDV species are likely to contain the large majority of their root biomass within the top few metres of the soil profile. This is partly related to the plant energy requirement to grow roots at depth and the greater suction required to extract water from depth.

Obligate phreatophytes that are adapted to shallow water tables (less than 2 m depth, for example) and a moderate degree of inundation and waterlogging are typically able to tap the capillary fringe and/or penetrate directly into the saturated zone with a large mass of shallow roots, which enables them to draw a relatively large proportion of their water requirement from groundwater. In contrast, facultative phreatophytes that occur in environments with deeper water tables (greater than 10 m depth, for example) can usually only access the capillary fringe via a relatively small number of roots, such that groundwater comprises only a relatively small proportion of total plant water use. It follows that GDV established over shallow water tables is likely to be much more sensitive to groundwater fluctuations than GDV established over deep water tables.

For Australian systems, evidence suggests that reliance on groundwater by terrestrial vegetation is greatly reduced in areas where the water table exceeds a threshold depth, likely to lie between 7 m and 12 m (Benyon, Theiveyanathan, and Doody 2006; Department of Water 2009; O'Grady, Carter, and Holland 2010; Zolfaghar et al. 2014), with 10 m suggested as a general threshold (Eamus, Froend, et al. 2006). An assessment of water level ranges of dominant riparian species across four Pilbara study sites indicated that the absolute maximum water level range was around 9 m (Loomes 2010). Vegetation may potentially access groundwater when the water table is between 10 m and 20 m depth, although it is thought to be negligible in terms of contribution to total plant water use (Zencich et al. 2002), and beyond 20 m depth, the probability of groundwater as a water source for vegetation is regarded as being low. In the case of groundwater mounding, there is evidence from the riverbanks, creeks and floodplains of Australian systems that although creekside *Eucalyptus* species can be tolerant to repeated flooding, trees tend to use water from unsaturated shallow soil and groundwater and not creek water (Thorburn and Walker 1994).

In general for the Iron Valley Project area, only eucalypts, which have sufficient biomass and longevity to develop roots beyond 20 m depth, are likely to be at any risk from groundwater level change within the 10 m to 20 m depth zone.

2.4.2 Magnitude of groundwater drawdown

From the previous section, it is self-evident that the magnitude of groundwater drawdown is directly related to the magnitude of impact on GDV. The likelihood of impact is clearly very high in situations when drawdown is of sufficient magnitude to lower the water table below the rooting depth of GDV. However, this influence decreases with increasing depth to groundwater pre-drawdown, due to a lesser pre-existing dependence on groundwater of GDV. That is, the lowering of a shallow water table by even a small amount can potentially have large consequences for obligate phreatophytes with shallow root systems that depend on groundwater for a large proportion of their water

requirement. On the other hand, further lowering of an already deep water table may not have a large impact on deep-rooted facultative phreatophytes for which groundwater comprises only a small proportion of total plant water use.

Available information on the ability of GDV to adjust to groundwater change suggests that changes of < 2 m can most likely be tolerated, but the consequences to plant health of changes > 2 m are often detrimental (Marcam Environmental 1998; Naumburg et al. 2005; Braimbridge 2010). A change of > 2 m may be considered necessary to result in a risk of impact when groundwater is deeper (for example > 5 m depth), however a more conservative change of > 1 m may be considered to have a risk of impact when groundwater is shallower (for example, < 5 m depth), taking into account the relatively greater vulnerability of GDV that is more highly dependent on groundwater.

2.4.3 Rate of groundwater drawdown

The rate at which vegetation is impacted by drawdown is directly proportional to the rate of groundwater drawdown. Gradual drawdown results in a slower progression of reduced water availability and a greater opportunity for plants to adapt to the altered groundwater regime, whereas rapid drawdown results in the rapid acceleration of negative impacts (Froend et al. 2004). In theory, plant roots can maintain a functional connection with groundwater as long as the rate of water table decline does not exceed potential maximum rate of root growth (Naumburg et al. 2005).

Little is known of the root growth rates of Pilbara GDV species. Evidence from the literature suggests that phreatophytic species would not be expected to maintain contact with groundwater when the rate of drawdown exceeds around 1 cm per day (Kranjcec, Mahoney, and Rood 1998; Scott, Shafroth, and Auble 1999; Horton and Clark 2001; Canham 2011), and once the water table falls below plant rooting depth, root elongation is contingent on there being sufficient water available from other sources to meet plant water requirements (Canham 2011). This suggests that a very rapid rate of drawdown in the order of 1 m over several months would likely pose a very high risk of impact to GDV, but a more gradual rate in the order of 0.5 m over several years would pose a much lower risk to GDV.

2.4.4 Surface water

The GDV that occurs along creeks in the Pilbara is adapted to episodic large rainfall events that can result in fast, high energy stream flows in the creek bed and the pooling of water in floodplains. These accumulations of surface water are usually only temporary, lasting over several days to weeks. Flowing water is rarely a permanent feature and the size and permanency of pools is highly variable. However, the dynamics of surplus water discharge into creeks differ considerably. Discharge occurs as a slow, steady release of water into creek. Flows are very low energy, which can lead to the creation of permanent large pools that engulf the full extent of tree root zones. This may suit some GDV species that are well adapted to long periods of flooding (for example, *Melaleuca argentea*), but harm other species that are not. On the other hand, the steady supply of water from discharge has the potential to recharge soil moisture in the underlying alluvium. This would potentially benefit facultative phreatophytic species (for example *Eucalyptus victrix*) that draw most of their water from the unsaturated zone, as long as they can support roots beyond the hyporheic zone and roots are not flooded by groundwater mounding.

2.4.5 Other factors

The magnitude and extent of GDV response to groundwater drawdown, mounding and surface water pooling is influenced by a range of other secondary factors including:

- rooting depth and spread of individual plants (determines the level of access to groundwater and soil moisture in the unsaturated zone)
- soil texture (determines the maximum amount of soil moisture in the unsaturated zone that can be utilised by plants in the absence of groundwater)
- antecedent soil moisture (determines the actual amount of soil moisture in the unsaturated zone that can be utilised by plants in the absence of groundwater)
- magnitude and frequency of rainfall (determines the extent to which the soil moisture in the unsaturated zone is replenished)
- structural and physiological factors such as transpiration rate, leaf area, and stand density (determined the rate at which soil moisture in the unsaturated zone is depleted)
- evaporative demand (determines the rate at which soil moisture in the unsaturated zone is depleted and the level of plant stress when there is insufficient water to meet plant water requirements).

2.5 Key Species

From previous vegetation surveys and anecdotal knowledge of riparian vegetation that occurs along the Marillana-Weeli Wolli Creek system, three key species with potential groundwater dependence are known to be present in the vicinity of the Project: *Eucalyptus victrix* (coolibah), *E. camaldulensis* (river red gum) and *Melaleuca argentea* (silver cadjeput).

Of note, the Marillana-Weeli Wolli Creek system is also known to support a range of other large woody species that commonly co-occur with *E. victrix* and *E. camaldulensis* in the riparian zone (for example, *Melaleuca glomerata*, *Corymbia candida*, *Acacia coriacea* and *Atalaya hemiglaucia*); very little is known about the water use, water sources or rooting depths of these species, and the possibility that some of the larger individuals (> 5 m in height) may also be dependent on groundwater to some degree cannot be discounted.

2.5.1 *Eucalyptus victrix*

E. victrix is a small to medium tree (5 m to 15 m) with a spreading form that occurs on red loamy or sandy soils and clay loams on floodplains and in low lying areas across the Pilbara and other areas in the north-west of Western Australia (Western Australian Herbarium 1998-2015). Mature *E. victrix* trees commonly support a large dimorphic root system, consisting of prominent tap roots and a network of laterally expansive roots near the soil surface and in the top 1 m to 2 m of the soil profile, which can extend to at least 10 m to 12 m away from the main stem, from which vertical sinker roots can also develop and potentially extend tens of metres to water table depth (Florentine 1999).

E. victrix is regarded as being a facultative phreatophyte that most likely draws the majority of its water requirement from the unsaturated zone, but can use groundwater opportunistically as required. Previous studies have shown that when provided with access to groundwater, *E. victrix* can maintain high leaf water potentials and high rates of tree water use during times of drought (O'Grady et al. 2009; Pfautsch et al. 2011; Pfautsch et al. 2014). However, *E. victrix* also demonstrates a strong ability to regulate water losses when water supplies are limited via regulation of stomatal conductance (Pfautsch et al. 2014) and structural modifications including leaf die-off,

crown defoliation and adjustment of leaf area to sapwood area ratio, which enables trees to maintain constant water use despite increasing evaporative demand if sufficient water is available (O'Grady et al. 2009). In general, the water use strategy of *E. victrix* appears to be highly plastic and opportunistic, enabling survival in a wide range of ecohydrological settings (Pfautsch et al. 2014). However, despite being a relatively plastic species, major adjustments to hydraulic architecture in large trees take time such that large changes in hydrology are likely to affect trees growing over historically shallow groundwater to a greater extent than trees that have developed over historically deeper groundwater, as highlighted in a recent study by Pfautsch et al. (2014). From an assessment of water level ranges of Pilbara riparian species, it was found that the mean minimum water level depth of *E. victrix* was greater than that for *E. camaldulensis*, providing some support for the view that *E. victrix* is found in slightly drier areas than *E. camaldulensis* and may not be as responsive to water table fluctuations (Loomes 2010).

Mature *E. victrix* trees display a moderate level of flooding tolerance. Mature trees are able to tolerate temporary inundation (days to weeks). The presence of adventitious roots and stem hypertrophy (the ability to increase the size of component cells) provides a level of tolerance to waterlogging in seedlings and saplings, allowing them to survive in flood-prone areas (Florentine 1999; Florentine and Fox 2002a). In fact, flooding events are believed to play a major role in the reproductive cycle of *E. victrix*, particularly for seedling establishment (Florentine and Fox 2002b).

2.5.2 *Eucalyptus camaldulensis*

E. camaldulensis is one of the most iconic and broadly distributed *Eucalyptus* species in Australia, and more is known about this species than nearly all others. Across its broad geographic distribution, *E. camaldulensis* populations display high genetic diversity with regard to hydraulic architecture, water relations and salt tolerance, reflecting how different populations have evolved and adapted to local climates and hydrogeological regimes (Colloff 2014). In the Pilbara, *E. camaldulensis* commonly occurs along water courses and river banks, growing in deep alluvial sand and sandy loams (Western Australian Herbarium 1998-2015). It is a small to large tree (5 m to 20 m) with a generally spreading form, but it displays a great diversity in height, form, trunk and leaf morphology (Western Australian Herbarium 1998-2015). Trees in riparian zones exposed to high energy flood events tend to have short, thick stems with irregular crowns or multiple stems diverging from a short trunk. Stems can sprout from epicormic buds in living tissue of the bole or root stock, and new stems can arise from horizontal stems fallen by flood, fire or windstorms. In less dynamic environments, fast-growing trees can grow tall and straight with even form similar to silvicultural plantations.

E. camaldulensis supports a large root system consisting of vertical tap roots with lateral roots branching off at right angles at several levels, and sinker roots extending downwards from laterals. Vertical sinkers provide support for the aboveground part of the tree and deep penetration of soil over a wider area than would be possible via a single taproot. Extension of the root system also allows for access to oxygen from unsaturated portions of the soil profile during periods of inundation, enhancing flood tolerance. Mature trees are thought to have roots to depths of at least 9 m to 10 m and possibly as deep as 30 m (Davies 1953, cited in Colloff 2014). Adventitious roots can grow out from boles or branches in response to flooding, for increased oxygen uptake and also as a form of vegetative propagation. Woody roots of this species are known to have large xylem vessels for fast, efficient rates of water transport and rapid recovery following water stress (Heinrich 1990 cited in Colloff 2014).

In general, *E. camaldulensis* is considered to be a facultative phreatophyte, with the capacity to utilise water from a range of different sources including rainfall, floodwater, stored soil water and groundwater (Mensforth et al. 1994). When conditions are favourable, *E. camaldulensis* tends to employ a 'going for growth' strategy that involves vigorous growth rates and high rates of water

uptake and transpiration from a dependable water source, often provided by groundwater or floodwaters that sustain groundwater recharge (Gibson, Bachelard, and Hubick 1994; Marshall et al. 1997; Morris and Collopy 1999). Hence, *E. camaldulensis* is generally regarded as being more heavily reliant on groundwater than *E. victrix*. When stressed, *E. camaldulensis* reduces transpiration and water demand by shedding leaves, and sometimes also whole branches, particularly lower limbs.

Where large *E. camaldulensis* trees are present, groundwater is usually present within the depth of the root zone, and in some environments depth to groundwater is a good predictor of the condition of *E. camaldulensis* stands. Some studies have observed a sharp decline in tree health and stand condition below a threshold depth or around 10 m to 12 m (England et al 2009 cited in Colloff 2014). The ability of *E. camaldulensis* to utilise groundwater has proven useful for lowering water tables and reclamation of saline land in agricultural regions of southern Australia, where water use can be in the order of 300 mm to 550 mm per year (1 mm to 1.5 mm per day) depending on stand density and access to water.

In the Pilbara, riparian communities containing *E. camaldulensis* occupy only a relatively small percentage of the landscape total area, but they are integral to the ecosystem function of riparian systems, providing vital refuge and resources for birds, mammals, reptiles, invertebrates and people in an otherwise dry landscape (Colloff 2014).

2.5.3 *Melaleuca argentea*

M. argentea is a medium size tree up to 20 m in height that normally grows along the banks of creeks, water courses and swamps. It has a predominantly shallow, flat root system, comprised mostly of surface lateral roots that can grow directly into standing or flowing water (Graham 2001; Loomes 2010; Department of Parks and Wildlife 2015).

M. argentea is considered an obligate phreatophyte that typically accesses surface expressions of groundwater or shallow water tables within 3 m of the soil surface. This species exhibits signs of stress and even death if the groundwater table falls by more than 0.5 m to 1 m (Astron, unpublished data), and this species does not appear capable of surviving above water tables deeper than around 5 m (Loomes 2010). Stream water (often linked groundwater discharge) is commonly the most important source of water for this species, which likely plays a key role in influencing the form and ecology of stream channels in northern Australia. Studies have also shown that even in higher rainfall environments in the tropical north of Australia, *M. argentea* remains predominantly reliant on groundwater and river water (O'Grady et al. 2006).

Compared to *E. victrix* and *E. camaldulensis*, the ecophysiology, water relations and water use behaviour of this species has rarely been studied and remain poorly understood.

3 Identification and Mapping of Groundwater Dependent Vegetation

GDV in the vicinity of the Project was identified using a combination of three different methods: visual inspection of available aerial imagery, analysis of multispectral satellite imagery, and on-ground reconnaissance. The area targeted for assessment was an approximately circular area with a radius of 10 km (31,416 ha), with the centre point located in the approximate centre of the tenement. This area encompassed the expected area of groundwater drawdown associated with BWT mining. Of note, actual groundwater dependency has not been confirmed for any vegetation in this study; hence all references to GDV should be regarded as referring to 'potential' GDV.

3.1 Inspection of Aerial Imagery

Available aerial imagery of the assessment area sourced from Google Earth, Landgate and BC Iron was compiled and visually inspected for the presence of GDV. Particularly close attention was paid to identifying individual large trees and clumps of trees in areas of the landscape that were likely to support GDV species, such as along major creeks, drainage lines and surrounding floodplains. Specific patches of vegetation thought to contain GDV were marked in GIS layers and on printed maps for comparison with other methods and to guide on-ground reconnaissance. Of note, the base layer for the maps produced in this report was an aerial image of the Weeli Wolli Creek system captured in 2004, sourced from Landgate.

3.2 Remote Sensing Analysis

A remote sensing analysis was carried out to identify GDV based on vegetation 'greenness' and 'wetness', and the persistence of greenness and wetness over time. Briefly, the analysis utilised freely available data sets from the Landsat satellite, a remote sensing platform that captures imagery across a number of spectral bands including across visible (VIS), near infrared (NIR) and short wave infrared (SWIR) wavelengths.

The capture of wavelengths in the NIR band is an important tool used in vegetation health monitoring primarily because healthy, green leaves strongly reflect NIR wavelengths. At the same time, chlorophyll in plant leaves absorbs red light. Therefore, where leaves are healthy and foliage is dense, there is greater absorption of red light and greater reflection of NIR per unit area. Comparing the NIR and VIS red bands of Landsat imagery provides the Normalised Difference Vegetation Index (NDVI), an index that is widely used for measuring vegetation cover and condition. NDVI is calculated as: $NDVI = (NIR - R) / (NIR + R)$, where NIR is the near infrared spectral band and R is the red spectral band.

The NDVI indicates the 'greenness' of target vegetation and ranges between -1 (snow and ice) to +1 (100% healthy and dense vegetation cover). In this way, NDVI is highly correlated with per cent canopy closure: if there is more reflected light in the NIR wavelengths then the vegetation of interest is likely to be dense. Thus, the difference between NIR and R reflectance from vegetation will reduce as vegetation health, or vegetation cover proportion within a pixel, reduces (Tucker 1979; Jensen et al. 1991; Heute 2012). A decline in live plant cover will therefore be reflected by a decrease in NDVI. Similarly, the 'persistence' of high NDVI values can be used to identify vegetation that remains consistently green and in good condition over time with little fluctuation in response to changes in climate (rainfall and drought), which by inference suggests access to reliable, consistent water sources, including groundwater.

Changes in NDVI are also frequently compared to changes in the Normalised Difference Water Index (NDWI), derived from the NIR and SWIR channels, which is considered to be a good proxy for plant water stress. The SWIR reflectance reflects changes in leaf water content and thus allows for

monitoring of the moisture condition of vegetation. NDWI is calculated as: $NDWI = (NIR - SWIR) / (NIR + SWIR)$.

For the analysis, a simplified version of the method of Barron et al. (2014) was used to identify and map GDV within the assessment area from analyses of NDVI and NDWI. The analysis used two Landsat data sets, one from the end of November 1996 following a prolonged dry period (dry), and the other from the end of May 2000 following a relatively wet period (wet). A four layer hyperplane, made up of $NDVI_{wet}$, $NDVI_{dry}$, $NDWI_{wet}$ and $NDWI_{dry}$ was used to perform an unsupervised classification of pixels to identify potential GDV. A k-means cluster analysis was applied to define a number of classes, after which a maximum likelihood algorithm was applied to assign pixel locations to classes. The final classification involved assigning pixels to one of four classes based on the persistence of greenness and wetness: non-drying vegetation, slow-drying vegetation, fast-drying vegetation and 'other' (for which NDVI values were too low to be significant vegetation), with the non-drying vegetation and possibly the slow-drying vegetation laying claim to represent GDV. Further technical details of the analysis are available upon request.

An important point to note about remote sensing analyses referred to in this report is that the scale and resolution of analyses needs to be taken into account when interpreting and extrapolating results. For example, the Landsat satellite captured imagery at a relatively coarse resolution of 30 m x 30 m pixels, which was appropriate for making inferences at the habitat/community scale, but not the individual tree scale.

3.3 On-ground Reconnaissance

On-ground reconnaissance and mapping of GDV was conducted by two senior scientists from Astron with experience in the identification and monitoring of GDV in the eastern Pilbara (R. Archibald and T. Bleby). Reconnaissance was undertaken over a period of three days, from 22 to 24 November 2015. A total of 19 sites were selected for inspection along a 25 km length of the Marillana-Weeli Wolli Creek system, with sites located approximately every 1.5 km to 3 km. These sites were pre-selected from a desktop analysis of aerial imagery prior to the trip. On-ground, 14 of the 19 sites were inspected. Sites 2 and 4 were not inspected because they occurred on tenements where survey work was not permitted. Sites 10 and 19 were determined to be redundant given their similarity to preferred sites nearby. Site 17 was determined not to contain GDV. Site 8 was inspected but only photographs were taken.

Most sites were directly accessible by vehicle via bush tracks and dry creek beds. Where possible, a north-south or east-west cross-section of the creek (up to 1.5 km) was traversed on foot to inspect vegetation in creek beds and on both sides of the floodplain (riparian uplands). The current monitoring transect was also re-assessed at the same time as annual monitoring activities were being undertaken.

Each site was described and rated for a range of qualitative parameters, as listed in Table 2. Field notes, photographs and GPS points of interest (including GDV boundaries) were also recorded at each site. The outline of GDV was transposed onto printed maps and then digitised to produce a GIS layer for electronic production. The mapping process to produce final GDV maps involved the interpolation of GDV boundaries along areas that were not inspected on-ground. On-ground observation of GDV were subsequently cross-checked with aerial imagery and GDV maps from remote sensing, and all three methods were then used in combination to interpolate the presence of GDV in areas that were not ground-truthed.

Table 2: Parameters and ratings used to describe groundwater dependent vegetation (GDV) inspection sites during on-ground reconnaissance. Ev = *Eucalyptus victrix*, Ec = *Eucalyptus camaldulensis*, Ma = *Melaleuca argentea*. DBH = diameter at breast (1.3 m) height.

Parameter		Term/rating	Description
GDV indicator species	Ev	Present/absent	Presence/absence of GDV indicator species in any form, including juvenile saplings
	Ec		
	Ma		
GDV tree size	Large		DBH > 0.5 m; height > 15 m
	Medium		DBH between 0.1 m and 0.5 m; height between 5 m and 15 m
	Small		DBH < 0.1 m; height < 5 m
GDV tree density	Dense		> 15 stems per ha
	Scattered		5 to 15 stems per ha
	Sparse		< 5 stems per ha
GDV tree health	Good		Majority of trees display dense foliage cover and appear in good visual health
	Moderate		Majority of trees display thinning foliage cover and visual health could be better
	Poor		Majority of trees display sparse foliage and visual health shows signs of decline
Vegetation strata	Overstorey		The dominant (tallest) tree canopy
	Midstorey		Vegetation that grows above the understorey but below the dominant tree canopy, including small trees and tall shrubs
	Shrubland		Vegetation that grows above the understorey but is lower than the midstorey, including medium size shrubs
	Understorey		Vegetation that grows at the lowest level below the dominant tree canopy, including low-lying shrubs, grasses and herbs
Surface water	Flowing		Flowing water in creek channel
	Pooled		Standing pools of water in creek channel
	Dry		Dry creek bed with no pools or flowing water
	High level		Relatively deep pools/channels of flowing water (> 1 m depth)
	Low level		Relatively shallow pools/channels of flowing water (< 1 m depth)
Distance from discharge	Close		< 5 km
	Near		5 km to 10 km
	Far		> 10 km

3.4 Results and Discussion

GDV in the vicinity of the Project is shown in a series of maps contained in Appendix A (Figure A.1). Mapping notes, site descriptions and relevant GPS points of interest are summarised in tables in Appendix A (Table A.1 and A.2). Site photographs are available upon request. The total area of GDV within the assessed area was 2,284 ha, including the current monitoring transect.

In brief, GDV was found to occur along the entire inspected length of the Marillana-Weeli Wolli Creek system (25 km), which stretched from the south-western corner to the far north of the assessed area (Figure A.1). Potential GDV was found to occur across entire cross-sections of the Creek, with a typical cross-section of the northern portion of Weeli Wolli Creek described as

containing scattered large *E. victrix* and *E. camaldulensis* along creek banks and within the open creek bed, and sparse large *E. victrix* over *Acacia* midstorey over native grass and buffel (*Cenchrus ciliaris*) understorey in the riparian uplands (floodplain) on both sides of the main channel (Figure A.1; Table A.1).

The southern portion of the Marillana-Weeli Wolli Creek system was clearly wetter and more highly productive than the drier northern portion of Weeli Wolli Creek, almost certainly as a result of discharge from surrounding mines. The southern portion supported large pools of water and significant stretches of flowing water, which in turn supported wetland areas with dense tall reeds, and dense patches of small to medium sized *E. victrix*, *E. camaldulensis* and *M. argentea* in addition to scattered large *E. victrix* and *E. camaldulensis*. Floodplain areas along the southern portion also tended to support denser stands of mid-storey *Acacia* species than the northern portion of Weeli Wolli Creek. The transition zone between the 'discharge affected' southern portion and the 'discharge unaffected' northern portion of Weeli Wolli Creek was the area around inspection site 6. The presence of discharge affected GDV is a major confounding influence with regard to monitoring for impacts of groundwater drawdown. The nature and magnitude of the effects of discharge on GDV in this portion of the system remains to be determined with certainty. In all likelihood, the discharge is likely to 'protect' much of the vegetation from groundwater drawdown while historical discharge regimes are maintained. A broad scale separation of GDV that has developed in response to discharge versus the pre-existing GDV would be possible via an analysis of Landsat imagery spanning the pre- and post-discharge period.

GDV trees were mostly observed to be in very good health along the entire length of the Creek system, except at inspection site 16 which was downstream from a section of the creek that had been blocked by development. Indications are that this site may have been the recipient of historic discharge that has since ceased, the result of which appears to have been the growth and subsequent decline of a partially 'artificial' GDV community (or 'discharge dependent community').

An area on the western edge of the floodplain at the southern base of a hill near inspection site 12 was found to support a potentially important community of medium to large *E. camaldulensis* trees that may or may not be reliant on groundwater. This patch of forest contained numerous tall, straight, evidently fast-growing trees with diameter at breast height of around 40 cm to 50 cm, and heights of around 20 m. Inspection of historic aerial images suggests that this stand may not be more than 10 to 15 years of age, and it may have enlarged after the commencement of discharge.

For the major Creek system, there was good general agreement between on-ground GDV observations and the remote sensing analysis (Appendix B, Figure B.1), taking into account the coarse pixel size (30 m x 30 m). In particular, there was good correspondence between the mapping of non-drying vegetation from remote sensing (red areas in Figure B.1) and the confirmed presence of large GDV trees along creek banks and within open creek beds. Similarly, the mapping of fast-drying vegetation (blue areas in Figure B.1) corresponded well with ground-truthed areas of non-GDV *Acacia* midstorey. Outside of the major Creek system, remote sensing results were regarded as being unreliable due to the spurious reflectance attributes of sparsely vegetated portions of the landscapes, particularly where topographical features such as incised river valleys cause significant light-shade contrasts. From ground truthing, these areas are known to be sparsely vegetated and do not support the presence of GDV.

4 Groundwater Management at Iron Valley

4.1 Numerical Modelling of Groundwater and Surface Water

According to the conceptual understanding of the groundwater system for the Iron Valley site (AQ2 2016), the Iron Valley orebody lies within a transmissive, mineralised orebody aquifer system with an overlying layer of alluvium. This aquifer system is connected to the Weeli Wolli Creek via a fault that will form a strong conduit for flow from the creek to the mine site. Substantial dewatering will be required to keep open mine pits dry during mining, which will have an effect on regional groundwater levels.

Mine water demand is predicted to be much less than that required for dewatering such that there will be a water surplus that will need to be disposed. Review of all possible disposal options has identified the disposal to the adjacent Weeli Wolli Creek as the most suitable option (AQ2 2016). At present, disposal is being considered at three locations adjacent to the mine along Weeli Wolli Creek: DL1, DL4 and DL5. Predicted abstraction and disposal volumes from 2016 to 2015 (end of mining) are listed in Table 3. Of note for this report, location DL1 is only used for four years and for the majority of the mine life the discharge is split 50/50 between locations DL4 and DL5.

Table 3: Water balance summary, with annual average rates in kL/d, reproduced from Table 4.8 in AQ2 (2016).

Year	Total dewatering	Maximum water demand	Surplus	Disposal to DL1	Disposal to DL4	Disposal to DL5
2016	62,707	15,700	47,007	15,010	15,999	15,999
2017	63,175	15,700	47,475	15,010	16,233	16,233
2018	60,166	15,700	44,466	15,010	14,728	14,728
2019	57,129	15,700	42,429	22,094	10,167	10,167
2020	22,263	15,700	6,563	0	3,282	3,282
2021	31,695	15,700	15,995	0	7,998	7,998
2022	30,305	15,700	14,605	0	7,303	7,303
2023	30,369	15,700	14,669	0	7,335	7,335
2024	42,756	15,700	27,056	0	13,528	13,528
2025	38,340	15,700	22,640	0	11,320	11,320

Dewatering and disposal of surplus water from the Iron Valley mine will have a cumulative effect on the prevailing groundwater and surface water conditions in the region, given the historical and ongoing disposal of excess water by Rio Tinto and BHPBIO to southern areas of the Marillana-Weeli Wolli Creek system.

Numerical modelling was recently undertaken to assess the impact of mining operations on groundwater and surface water conditions in the area surrounding the mine (AQ2 2016). The model included:

- the aquifers associated with orebodies and the Weeli Wolli Creek
- recharge to the aquifer system from surface water flows in the Weeli Wolli Creek
- dewatering of the orebody aquifer
- groundwater inflow from the upper Weeli Wolli Creek catchment
- groundwater outflow to downstream.

A number of different scenarios were modelled over the expected life of the Iron Valley Mine (10 years), two of which were used in this report to assess the risk to GDV. These two scenarios, referred to as the Base Case and the Rio Tinto Case, are listed in Table 4.

Table 4: Summary of model predictions used to assess the risk to groundwater dependent vegetation from Iron Valley mining operations, modified from Table 4.7 in AQ2 (2016). TSF = Tailings Storage Facility.

Scenario	Description	Model inclusions	Model predictions used in this report
Base Case	Iron Valley impacts from dewatering and surplus disposal	• Dewatering from Iron Valley • Surplus disposal from Iron Valley • Operation of the TSF • Climatic variability (recharge from the Weeli Wolli Creek)	• Groundwater drawdown contours (end of mining, 2025) • Iron Valley surface water wetting front (end of mining, 2025)
Rio Tinto Case	Iron Valley impacts plus surplus disposal from Rio Tinto's proposed mine expansion	• Dewatering from Iron Valley • Surplus disposal from Iron Valley • Operation of the TSF • Climatic variability (recharge from the Weeli Wolli Creek) • Recharge from the Weeli Wolli Creek from Rio Tinto's Pocket and Billiard Operations	• Groundwater drawdown contours (end of mining, 2025) • Cumulative surface water wetting front (end of mining, 2025)

The full results of groundwater modelling are documented in AQ2 (2016) and only a short description is presented here to provide context for this report. Briefly, results for the Base Case suggest that during the mine life, groundwater levels around the mine and in parts of Weeli Wolli Creek would be lowered; however there are other areas where groundwater mounding would occur and water levels would rise to the surface in the creek, resulting in surface flow. For the Rio Tinto Case, groundwater levels would be lowered around the mine similar to the Base Case, but water levels would rise across most of the Weeli Wolli Creek system resulting in surface water flow that would likely extend for many kilometres along the creek (Appendix C). In effect, it was concluded that should Rio Tinto proceed with their expansion, their excess water disposal will override the predicted drawdown in the area of Weeli Wolli Creek from Iron Valley dewatering (AQ2 2016). According to modelling, groundwater levels are projected to recover to an equilibrium level relatively quickly (within 10 years) once abstraction has ceased.

With regard to surface water flow in the creek, AQ2 developed an analytical water balance model to predict the distance that dewatering discharge would travel downstream as surface flow from the discharge point (AQ2 2016). Briefly, the model split the alluvium creek aquifer into a number of consecutive downstream 'storage buckets', and used a cumulative monthly time series of estimated total creek discharges to fill each bucket and track how far downstream the discharges would fill. Input parameters for the model included an alluvium thickness of 15 m and alluvium width of 400 m.

For the Base Case, the surface water model predicted that the seepage front (wetting front) from the dewatering discharge would extend by approximately 6 km downstream of a single discharge point. Based on a 50/50 split of discharge between DL4 and DL5, it was assumed that a wetting front would extend 3 km downstream from each location, with the total wetting front for the Iron Valley disposal extending 6 km downstream of DL4. Although not modelled by AQ2, the Base Case must also necessarily include surface water flows as a result of current discharge by Rio Tinto operations. For this report, the wetting front from Rio Tinto's surplus discharge was conservatively assumed to extend 9 km downstream of the Marillana-Weeli Wolli Creek confluence as estimated by Dogramaci et al. (2014). For the Rio Tinto Case, the modelled wetting front was predicted to extend well

beyond that predicted for the Base Case, as far as 23 km downstream from the Marillana-Weeli Wolli Creek confluence.

4.2 Conceptual Model of Surface Water Impacts

In the absence of a specific mechanistic model describing actual water flows, surface pooling and other surface water dynamics for Weeli Wolli Creek system, a simple conceptual model was developed for this report to describe the potentially harmful effects of surface water on GDV along the length of the wetting front. This model, which builds on the numerical surface water flow modelling undertaken by AQ2, is presented in Figure 1 and accompanying Table 5.

The conceptual model attempts to describe the reasonable assumption that surface flows, subsurface flows in the hyporheic zone, and the degree of saturation (waterlogging) of underlying alluvium will be greatest at the point of discharge and then diminish with increasing distance downstream. The model is framed on AQ2's model parameters that specify an alluvium width of 400 m and depth of 15 m. Conceptually, this can be applied to the creek bed such that the 400 m width spans 200 m either side of the creek bed centre line, working on the assumption that discharge occurs into the centre of the creek bed. Soil moisture in the alluvium to 15 m depth is assumed to be fully recharged to the point that surface water can be expressed. The 'waterlogging zone' closest to the discharge point (that is the super saturated zone in which subsurface flows might occur and plant roots would be exposed to hypoxic conditions) is assumed to extend to only the first few metres depth but deep enough to compromise the health of inundated large trees, with this zone expected to shrink laterally and vertically with increasing distance downstream of the discharge point.

When applied to the Marillana-Weeli Wolli Creek system, division of the linear length of projected wetting fronts into the defined surface water impact zones was based on on-ground observations of the wetting front from the ongoing Rio Tinto discharge, which putatively extends from the Rio Tinto discharge point along Marillana Creek (RTIO DL) to 9 km downstream of the Marillana-Weeli Wolli Creek confluence (Dogramaci et al. 2014). On-ground, it was observed that large permanent pools and flowing water were concentrated in the first 1 km to 2 km downstream of the discharge point; however it was conservatively estimated that the length should be divided equally to assign zones 1, 2 and 3 to account for seasonal effects and inter-annual variability in rainfall.

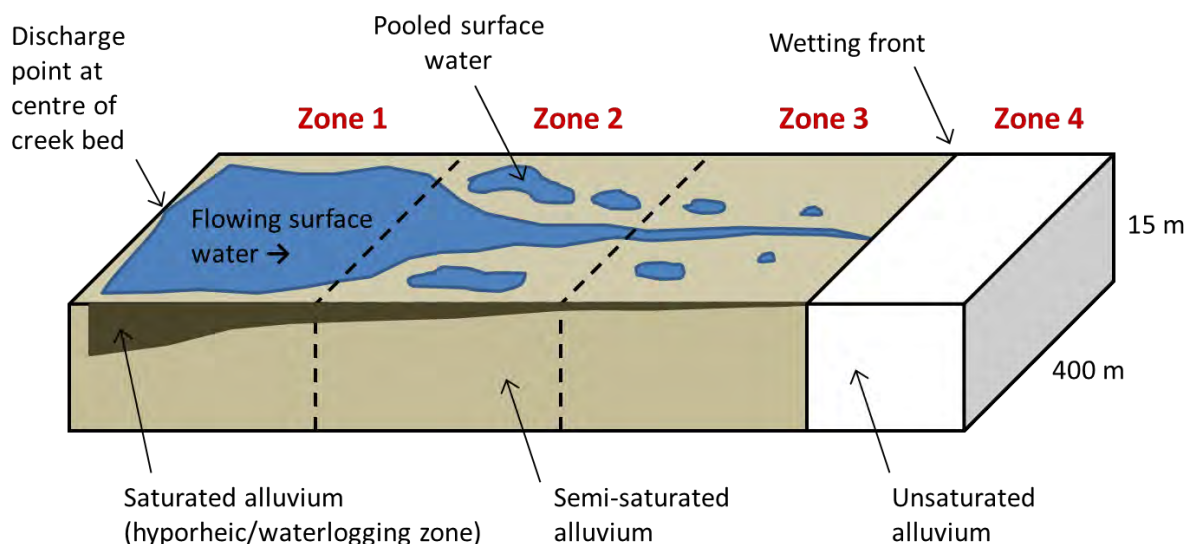


Figure 1: Conceptual model of the presence of surface water with increasing distance downstream of a discharge point, divided into four impact zones. Impact zones and the potential impact of surface water on groundwater dependent vegetation within each zone are described in Table 5. Not drawn to scale.

Table 5: Description of surface water impact zones as shown in the conceptual model presented in Figure 1.

Surface water impact zone	Description	Effects on GDV		
		Inundation	Waterlogging	Likelihood of negative impact on health
1	Permanent surface and subsurface (hyporheic zone) flows across wide expanses of the creek.	Permanent inundation	Permanent waterlogging of large portion of surface root system	High
2	Permanent surface flows across narrow channels in the main creek bed. Large number of isolated large permanent and semi-permanent pools across wide expanses of the creek.	Regular inundation for months at a time	Moderate waterlogging affecting large portion of surface root system	Moderate
3	Semi-permanent surface flows across narrow channels, mainly restricted to the main creek bed, tapering to zero flow near the wetting front. Small number of isolated small permanent and semi-permanent pools, mostly restricted to the main creek bed.	Occasional inundation for several days to weeks at a time	Occasional mild waterlogging affecting small portion of surface root system, predominantly only very shallow roots	Low
4	No discharge-related surface water. Surface water only accumulates and flows during and shortly after significant rainfall events and then recedes.	None	None	Negligible

5 Risk Assessment

A risk assessment was conducted to identify areas of GDV in the vicinity of the Project that may be at high risk of impact from groundwater dewatering and discharge of surplus water into Weeli Wolli Creek. The specific risk under consideration is a biologically significant decline in GDV tree health. The aim of the assessment was to provide information that can be used to inform the selection of GDV management zones and monitoring sites inside the expected impact zone.

To frame the assessment, GDV risk was conceptualised as being determined by:

- exposure to unfavourable surface water conditions arising from the direct discharge of water into the creek bed.
- exposure to change in the groundwater level (compared to the pre-development level) arising from the combined effect of dewatering and discharge.

A simple risk model was developed to assess GDV risk, applied to the area of GDV identified and described in Section 3 and Appendix A, referred to as the GDV risk area. A scoring system for surface water impacts (SWI) and groundwater impacts (GWI) was developed for input into a risk model, as described in the sections below. The risk model was then applied to assess both the Base Case and the Rio Tinto Case scenarios.

5.1 Risk Model

5.1.1 Surface water impact score

Surface water impact scores represented the likelihood of a negative impact on GDV occurring as a result of direct discharge into the Creek. The assignment of scores was dependent on the proximity of GDV to the point of discharge, as described by the conceptual model of surface water accumulation for the Weeli Wolli Creek system presented in Section 4.2 (Figure 1 and Table 5). This model defines the specific area within the creek system that is at risk of SWI, along with four different levels (zones) of impact based on the distance downstream from the point of discharge. The model describes how surface water impacts are expected to diminish with increasing distance downstream.

Prior to assigning surface water impact scores, the GDV risk area was subdivided to define the area that was subject to both groundwater and surface water impacts (GWI+SWI risk area) and the area that was subject only to groundwater impacts (GWI risk area). Specifically, the GWI+SWI risk area was defined as the area within the GDV risk area that was 200 m either side of the main creek bed of the Marillana-Weeli Wolli Creek system, based on the assumption that water is discharged directly into the main creek bed.

Division of the GWI+SWI risk area into the surface water impact zones and subsequent assignment of surface water impact scores was based on linear division of the creek bed centre line. As a general rule, the length between the discharge point and the wetting front was divided equally to assign zones 1, 2 and 3, while the length downstream of the wetting front was assigned to zone 4.

For the Base Case, the length of the wetting front associated with current Rio Tinto discharge was assumed to extend 9 km downstream from the Marillana-Weeli Wolli Creek confluence (AQ2 2016; Dogramaci et al. 2014), while the length of the wetting front for the Iron valley discharge points considered (DL4 and DL5) was assumed to be 3 km downstream from each point (AQ2 2016).

For the Rio Tinto Case, zone 1 was conservatively assumed to extend all the way from the southern extents of the GWI+SWI risk area to the projected Iron Valley (Base Case) wetting front. This took into account the cumulative impacts of discharge from DL4 and DL5 on top of discharge from the Rio Tinto expansion upstream. The length of creek between the Iron Valley wetting front and the cumulative wetting front was then equally divided to assign zones 2 and 3.

For both cases, areas upstream of the Marillana-Weeli Wolli Creek confluence along Weeli Wolli Creek areas upstream of the current Rio Tinto discharge point along Marillana Creek were assigned to surface water impact zones based on on-ground observations.

The surface water impact scoring system is outlined in Table 6, along with a brief summary of the likely reasons for negative impacts (inundation and waterlogging) as suggested by the conceptual model (Figure 1, Table 5). Surface water impact scores were applied only to the GWI+SWI risk area.

Table 6: Description of surface water impact scores used in the risk model. These scores were applied only to the area within the groundwater dependent vegetation (GDV) risk area that was considered to be at risk from surface water impacts. MC = Marillana Creek, WWC = Weeli Wolli Creek. Surface water impact zones relate to the conceptual model presented in Figure 1 and Table 5.

Surface water impact zone	Surface water impact score	Distance downstream from the MC-WWC confluence (km)		Likely period of inundation	Likely degree of waterlogging	Likelihood of a negative impact ¹
		Base Case	Rio Tinto Case			
1	3	All areas upstream of the confluence along WWC		Permanent	Severe	High
		0 to 3	0 to 15 ⁴			
		9 ² to 10				
		12 ³ to 13				
2	2	0 km to 1 km upstream from the Rio Tinto discharge point along MC		Regular	Moderate	Moderate
		3 to 6	15 ⁴ to 19			
		10 to 11				
		13 to 14				
3	1	All areas > 1 km upstream from the Rio Tinto discharge point along MC		Occasional	Mild	Low
		6 to 9 ²	19 to 23 ⁵			
		11 to 12 ³				
		14 to 15 ⁴				
4	0	> 15 ⁴	> 23 ⁵	None	None	Negligible

1. Negative impact as a result of GDV roots becoming waterlogged and/or intolerance to inundation.

2. Iron Valley discharge location DL4.

3. Iron Valley discharge location DL5.

4. Base Case wetting front (AQ2 2016).

5. Rio Tinto Case wetting front (AQ2 2016).

5.1.2 Groundwater impact score

Groundwater impact scores represented the likelihood of a negative impact on GDV occurring as a result of a change in the groundwater level. Scores were assigned depending on whether the change in groundwater level was a projected decrease (drawdown) or increase (mounding), as described in Table 7. Surface water impact scores were applied only to both the GWI risk area and the GWI+SWI risk area.

In the case of drawdown, impact scores were assigned according the projected magnitude of drawdown (m). This was justified as follows: where GDV is initially present, it can be reasonably inferred (by definition) that groundwater is initially in contact with plant roots to some degree. From this, the potential impact of groundwater drawdown on GDV can be considered solely on the basis of the magnitude of drawdown without the need for exact knowledge of water table depth or maximum plant rooting depths, which cannot be determined with certainty. It is simply assumed that for any degree of initial root contact with groundwater, a larger decrease in the groundwater level is likely to have a greater impact on GDV than a smaller decrease.

In the case of mounding, impact scores were assigned according to the projected depth of the water table below ground (mbgl), rather than the magnitude of mounding. The justification for this is that although maximum rooting depths are uncertain, it is reasonable to assume that the root distribution of GDV species decreases exponentially with depth such that the closer the groundwater level is to the surface, the greater proportion of roots are potentially affected in a negative way by waterlogging associated with mounding.

Groundwater impact scores were spatially assigned by overlaying groundwater contour maps of projected drawdown and projected depth to water table on the mapped GDV risk area. These contour maps were the result of modelling that took into account the combined effects of both groundwater abstraction and discharge. Contour maps were supplied by AQ2 (2016) for both the Base Case and the Rio Tinto Case. Groundwater drawdown maps used positive numbers to represent a water level decrease and negative numbers to represent a water level increase such that drawdown areas could be distinguished from mounding areas. This enabled assignment scores to drawdown areas based on the magnitude of drawdown, and the assignment of scores to mounding areas based on depth to the water table, as per Table 7.

Table 7: Description of groundwater impact scores used in the risk model.

Groundwater impact score	Groundwater level decrease			Groundwater (gw) level increase		
	Projected drawdown (m)	Likely access to groundwater ¹	Likelihood of a negative impact	Projected gw level (mbgl)	Likely degree of waterlogging	Likelihood of a negative impact
6	> 10	No access	High	< 2	Severe	High
4	5 to 10	Limited access	Moderate	2 to 5	Moderate	Moderate
2	1 to 5	Some access	Low	5 to 10	Mild	Low
0	< 1	Full access	Negligible	> 10	None	Negligible

1. Relative to original level of access prior to development.

5.1.3 Risk score

As stated previously, the specific risk under consideration is a biologically significant decline in GDV tree health. For this assessment, risk was quantified in terms of an estimated probability (%) that a decline will occur.

Conceptually, risk models are designed based on the standard convention of defining *Risk* as the product of *Likelihood* and *Consequence* (Burgman 2005). In this assessment, likelihood represents the probability that a decline in GDV health will occur, represented by the groundwater and surface water impact scores as outlined above. Consequence represents the magnitude of decline, scored simply as either a one for vegetation at risk (that is, vegetation within the defined GWI and GWI+SWI risk areas) or zero for vegetation not at risk (all other surrounding vegetation within the assessment area). Logically, GDV species (including obligate phreatophytes such as *M. argentea* and facultative phreatophytes such as *E. victrix* and *E. camaldulensis*) face a greater consequence in response to groundwater drawdown of any given magnitude than species with minimal or no dependence on groundwater (for example, midstorey *Acacia* species'). Similarly, GDV species that occur in the path of direct discharge into the creek bed face a greater consequence than species that occur away from the creek bed. Thus, risk was determined simply as that defined by likelihood.

Final risk score for the GWI risk area was defined as the groundwater impact score, whereas the final risk score for the GWI+SWI risk area was defined as the sum of the groundwater impact score and the surface water impact score. Spatial layers for each of the impact scores were overlaid to calculate the final risk scores. Risk ratings were then assigned as outlined in Table 8, and the Low, Moderate and High risk ratings were mapped.

Of note, surface water impact scores were numerically less than groundwater impact scores, but no meaning should be attributed to this. The scoring system was formulated to produce a ranking of different scenarios for the GWI+SWI risk area that was both logical and intuitively reflected the relative contribution of each component. The scoring system was not designed to directly compare the magnitude of impact of each component. It is not implied, for example, that in areas with a groundwater impact score of 6 are subjected to double the impact of areas with a surface water impact score of 3. Risk scores for some example scenarios are provided in Table 9.

Surface water discharge plays a potentially positive role for GDV in areas where there is groundwater drawdown and it is recognised that this is not fully accounted for in the risk scoring system. The degree to which surface water can recharge underlying alluvium and the effect this has on mitigating loss of contact with groundwater for GDV species remains uncertain and difficult to estimate based on current information. After some consideration, this aspect was deemed too uncertain to include in the risk model; a conservative approach was taken to leave it out.

Table 8: Final risk scores used in the risk model.

Risk rating	Risk score	Estimated probability of decline
High	6 to 9	50% to 100%
Moderate	3 to 5	10% to 50%
Low	1 to 2	< 10%
Negligible	0	0

Table 9: Risk scores for example scenarios of where groundwater dependent vegetation is exposed to groundwater drawdown or mounding and surface water.

Projected groundwater drawdown (m)	Projected groundwater mounding (mbgl)	Groundwater impact score	Surface water impact zone	Surface water impact score	Risk score	Risk rating
> 10	-	6	1	3	9	High
> 10	-	6	4	0	6	High
5 to 10	-	4	2	2	6	High
5 to 10	-	4	3	1	5	Moderate
5 to 10	-	4	4	0	4	Moderate
1 to 5	-	2	2	2	4	Moderate
1 to 5	-	2	4	0	2	Low
< 1	-	0	1	3	3	Moderate
< 1	-	0	2	2	2	Low
< 1	-	0	4	0	0	Negligible
-	< 2	6	1	3	9	High
-	< 2	6	4	0	6	High
-	2 to 5	4	2	2	6	High
-	2 to 5	4	3	1	5	Moderate
-	2 to 5	2	4	0	2	Low
-	5 to 10	2	1	3	5	Moderate
-	5 to 10	2	2	2	4	Moderate
-	> 10	0	1	3	3	Moderate
-	> 10	0	2	2	2	Low
-	> 10	0	4	0	0	Negligible

5.1.4 Assumptions and limitations

It is important to state that the risk assessment is a hypothesis that provides only a general indication of risk. Although based on the best available knowledge of the GDV species involved, and the best available projections of groundwater levels and surface water from modelling (AQ2 2016), it is qualitative and involves some broad assumptions. Use of a simplified risk model was the only feasible approach taking into account the following:

- the coarse spatial resolution of GDV mapping, in which GDV status was assigned based simply on the presence of any of the following indicator species, irrespective of tree density or size: *E. victrix*, *E. camaldulensis* and *M. argentea*
- the coarse spatial and temporal resolution of projected groundwater drawdown contours
- response to drawdown reaches a limit, that is, increments of drawdown well beyond the maximum depth of the root zone will not cause any further response in GDV
- an incomplete understanding of the impact of inundation and waterlogging on established vegetation communities within the GDV risk area (for example, waterlogging tolerances of individual species).

Appropriately, in recognition of these limitations and assumptions, the risk model was conservative.

The conceptual model for surface water (Section 4.2, Figure 1 and Table 5) was developed in an attempt to provide guidance and limit bias in attributing surface water impacts to GDV given that there is currently no quantitative understanding of the relationship between inundation and waterlogging on GDV health for the Weeli Wolli Creek system. This approach has obvious limitations, but it provides a necessary starting point to frame these interactions, and it should be viewed as just one component of a generally broad assessment.

5.2 Results and Discussion

5.2.1 Risk assessment

GDV areas assessed to be at risk of decline from the combined effects of groundwater drawdown and discharge are shown in Figure 1 for the Base Case and Figure 2 for the Rio Tinto Case. The areas of vegetation in each risk category listed in Table 10. The area of vegetation assessed within the tenement was 26 ha.

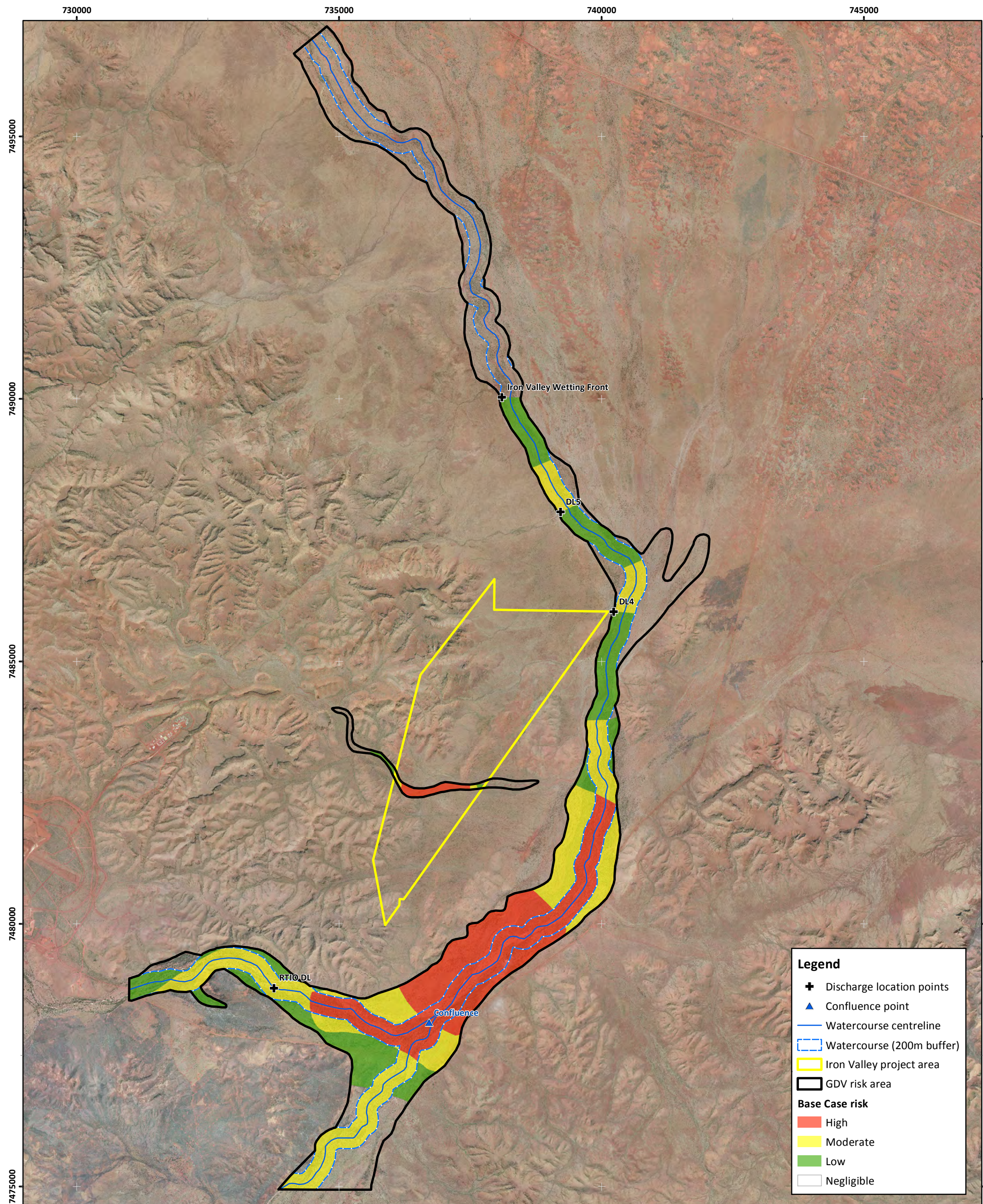
For the Base Case (Figure 1), approximately one quarter of the GDV risk area (591 ha) was assessed to be at high risk (Table 10), spread across the area of the main creek bed from the Rio Tinto discharge point (RTIO DL) to approximately 6 km downstream of the Marillana-Weeli Wolli Creek confluence. The high risk area was also expanded out across the entire width of the GDV risk area along a 4 km portion downstream from the Marillana-Weeli Wolli Creek confluence. High risk was associated with groundwater drawdown from the Iron Valley mine coupled with surface water impacts from the existing Rio Tinto discharge. Surface water impacts from the Iron Valley discharge were assessed to pose a moderate risk immediately downstream of the discharge points (DL4 and DL5), with no risk to GDV beyond the projected Iron Valley wetting front where although groundwater levels are projected to rise, the water table remains relatively deep.

Similar to the Base Case, approximately one quarter of the GDV risk area (583 ha) was assessed to be at high risk (Table 10) for the Rio Tinto Case (Figure 2). High risk for the Rio Tinto Case was predominantly associated with surface water impacts along the main creek bed, from the Rio Tinto discharge point (RTIO DL) to around 14 km from the Marillana-Weeli Wolli Creek confluence, a couple of kilometres beyond the furthest Iron valley discharge point. In this case, high risk was associated with cumulative surface water impacts coupled with groundwater mounding in areas where groundwater levels were projected to rise very near the surface, which in some instances was also assessed to impose a high risk to GDV beyond the main creek bed.

Table 10: Areas of groundwater dependent vegetation (GDV) at risk for the Base Case (Figure 2) and the Rio Tinto Case (Figure 3). Areas do not include vegetation within the Iron Valley tenement boundary. The total area of vegetation assessed within the GDV risk area was 2,542 ha, out of a total assessed area of 31,416 ha (area within a 10 km radius of the Iron Valley mine).

Risk to GDV	Estimated probability of decline	Area of vegetation in ha (% of GDV risk area)	
		Base Case	Rio Tinto Case
High	50% to 100%	591 (23%)	583 (23%)
Moderate	10% to 50%	665 (26%)	676 (27%)
Low	< 10%	418 (16%)	739 (29%)
Negligible	0	867 (34%)	544 (21%)

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Legend

- ✚ Discharge location points
- ▲ Confluence point
- Watercourse centreline
- - - Watercourse (200m buffer)
- Yellow box Iron Valley project area
- Black outline GDV risk area

Base Case risk

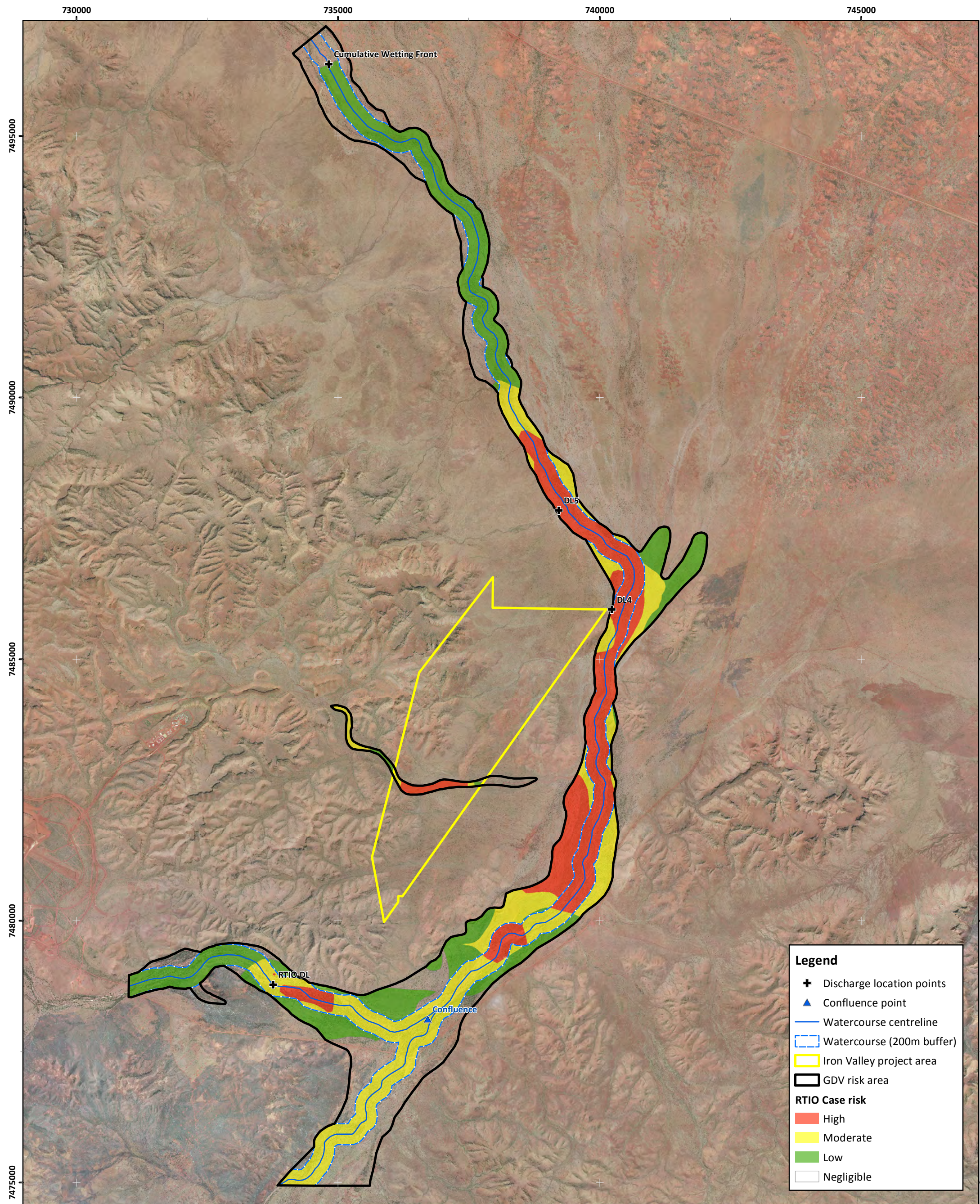
- Red box High
- Yellow box Moderate
- Green box Low
- White box Negligible

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Figure 2: Base Case - Groundwater abstraction and discharge risk model

Author: T. Bleby	Date: 05-02-2016	Coordinate System: GDA 1994 MGA Zone 50 0123 Kilometres N
Drawn: C. Dyde	Figure Ref: 13016A-15-MODR-1RevB_160205_Fig2_Base	



Legend

+

 Discharge location points

▲

 Confluence point

—

 Watercourse centreline

- - -

 Watercourse (200m buffer)

Iron Valley project area

GDV risk area

RTIO Case risk

High

Moderate

Low

Negligible

BC Iron Ltd
Iron Valley Groundwater Dependant Ecosystem Investigation

Figure 3: Rio Tinto Case - Groundwater abstraction and discharge risk model



Author: T. Bleby

Date: 05-02-2016

Drawn: C. Dyde

Figure Ref: 13016A-15-MODR-1RevB_160205_Fig3_RTIO

Coordinate System: GDA 1994 MGA Zone 50

Kilometres

0

1

2

3



5.2.2 Cumulative impacts of discharge

The risk assessment presented in this report considers the combined impacts of groundwater drawdown, mounding and surface water as a result of dewatering and discharge for the Iron Valley mine, along with the additional impact of discharge from neighbouring Rio Tinto mines. With regard to the cumulative impacts of discharge, the Rio Tinto Case assessed at the end of the Iron Valley mine life can be considered the ‘worst case scenario’.

It is difficult to provide an accurate assessment of the cumulative impacts of discharge. Weeli Wolli Creek is an already impacted system that has already been subject to cumulative impacts from multiple sources. Such cumulative impacts are inherently complex and difficult to predict. On the one hand, there are sections of the creek where new GDV communities have become established only as a result of discharge, and where discharge most likely partially contributes to maintaining the health of pre-existing large trees via the recharge of soil moisture in the underlying alluvium, which is likely to benefit the facultative phreatophytes *E. victrix* and *E. camaldulensis*. These communities may continue to flourish and expand with additional discharge.

On the other hand, pre-existing large trees of these species are not well adapted to permanent water logging, rather, they are adapted to temporary periods of inundation that accompany high creek flows and flooding following cyclonic rainfall events. Permanent inundation and waterlogging arising from large volumes of discharge is likely to result in the decline of some vegetation including potentially the loss of large trees including *E. victrix* and *E. camaldulensis*. The extent to which large trees might be affected largely depends on the spatial distribution of trees in relation to areas of permanent water and the proportion of individual root systems that is subject to permanently waterlogging. If waterlogging impacts turn out to be highly localised, then it may be that the number of trees within the high risk area that are actually at high risk may be relatively small.

Contours of predicted groundwater level changes from Rio Tinto’s disposal activities indicate that substantial mounding of groundwater levels will occur along the whole of the Weeli Wolli Creek system around the Iron Valley mine (see Appendix C). As noted in the AQ2 (2016) report, the magnitude of mounding in the southern (upstream) portion of the creek is approximately the same as the magnitude of drawdown predicted to occur from the Iron Valley Project, suggesting that discharge from upstream operations may have the beneficial effect of mitigating any negative impacts of dewatering. However, in the mid to northern (downstream) portions of the creek, it is likely that additional discharge from the Iron Valley mine would have a cumulative effect on mounding and surface water impacts that increases the risk to GDV.

5.2.3 Recovery after mining

It is difficult to predict with any certainty the long term consequences and recovery potential of GDV once groundwater and surface water regimes have stabilised and are back under natural influences after mining at Iron Valley has ended. According to AQ2’s modelling, groundwater levels and creek water levels are projected to recover to an equilibrium level relatively quickly (within 10 years) once abstraction and discharge have ceased.

With regard to groundwater, there is a possibility that some GDV may potentially become adapted to groundwater mounding by increasing the allocation of roots to surface soil layers and dispensing with deeper roots. These individuals may then struggle to grow deeper roots fast enough to ‘catch up’ with falling groundwater levels. With regard to surface water it is likely that GDV communities would become adapted to the new surface water regime given sufficient time. However, this also means that adapted communities would not then be equipped to deal with the sudden decrease or

removal of water supplied by discharge. It is reasonable to suggest that a phased withdrawal of discharge would be less risky to GDV than simply 'turning off the tap'.

From a broader perspective, the Marillana-Weeli Wolli Creek is a fairly large ecosystem that may have some potential to buffer the temporary impacts of mining. The lifespan of established large trees is in the order of hundreds of years and if not subject to catastrophic change, would be expected to endure. This system also supports many healthy populations of the GDV species of interest both upstream and downstream of mining activities, providing a pool for recruitment should there be a loss of GDV in some areas. Overall, recovery of the ecosystem is expected, particularly if management measures such as staged discharge reduction are implemented.

6 Future Monitoring of Groundwater Dependent Vegetation

6.1 Requirement for Monitoring

Given the presence of significant GDV in the vicinity of the Project area, it is anticipated that there will be a monitoring requirement associated with any future approval for groundwater abstraction associated with BWT mining.

A carefully devised monitoring approach would be required to detect changes to tree health both upstream (already impacted by discharge and threatened by drawdown) and downstream (threatened by groundwater mounding cumulative discharge) of the creek system to demonstrate whether or not the Project has any negative (or possibly positive) effect on GDV as it is now and as it may potentially change in response to additional discharge by Rio Tinto.

Below is an outline of a potential monitoring program of the type that may be required to meet regulatory requirements. Note that this is an example only, and it does not represent a proposed final program suitable to meet the needs of regulators. This example is based on the assumption that the current monitoring program for AWT mining will be proposed as a model with some slight modifications to meet the needs of BWT mining.

6.2 Brief Outline of Potential Monitoring Program

6.2.1 Objective

The objective of monitoring would be to detect any changes to the health and condition of GDV attributable to groundwater drawdown associated with BWT mining operations at the Iron Valley Mine, in order to maintain compliance with legislative requirements for the Project. It is anticipated that specific GDV management zones with accompanying management objectives, targets and appropriate monitoring triggers would be formulated once legislative requirements are known. The objective would also be to incorporate an adaptive management approach that allows for regular revision of the monitoring program.

6.2.2 Design

The design of the monitoring program would be based on the Before-After, Control-Impact approach. Monitoring would be initiated as soon as possible to acquire a suitable amount of data over a baseline period before the commencement of dewatering. Monitoring would continue during and post dewatering for as long as mandated, possibly up to the end of life of mine. Monitoring would be conducted at a number of potential impact sites where GDV is a medium to high risk of decline in response to dewatering, and at appropriate control sites outside the expected area of groundwater drawdown.

6.2.3 Monitoring Sites

Potential monitoring sites are summarised in Table 11, drawn from the pool of inspection sites visited during the on-ground reconnaissance (Appendix A). These sites take into account the identified risk areas for both the Base Case and Rio Tinto Case scenarios and an appropriate level of spatial coverage from north to south along the Creek system. These sites are suggestions only and provide a starting point for a more in-depth consideration of monitoring requirements once legislative requirements are known. One approach may be to divide the Creek system into different management zones each with their own set of management objectives, targets and triggers to

account for the potentially different impacts of groundwater drawdown, mounding and surface water discharge.

Table 11: Summary of proposed monitoring sites for a potential expanded groundwater dependent vegetation (GDV) monitoring program for the Iron Valley Project. Ec = *Eucalyptus camaldulensis*. N/A = Not Applicable. Assessed risk is based on the Rio Tinto Case.

Inspection site	Site type	Risk type	Assessed risk to GDV	Comment
18	Potential impact	Mounding and discharge	High	Downstream of Iron Valley discharge location DL5
5	Potential impact	Mounding and discharge	High	Downstream of Iron Valley discharge location DL4
7	Potential impact	Mounding and discharge	High	Downstream of current Rio Tinto discharge point
9	Potential impact	Mounding and discharge	High	Downstream of current Rio Tinto discharge point
11	Potential impact	Mounding and discharge	Moderate	Downstream of current Rio Tinto discharge point
14	Potential impact	Mounding and discharge	Moderate	Downstream of current Rio Tinto discharge point
12	Potential impact	Mounding	Low	Ec forest
Upstream of 3	Potential impact	Discharge	Low	Downstream of Iron Valley wetting front
Downstream of 3	Reference	N/A	Negligible	Downstream of cumulative wetting front
1	Reference	N/A	Moderate	Upstream of cumulative impact zone

6.2.4 Monitoring Parameters and Methods

Monitoring parameters that would enable tracking of performance against specified management targets and monitoring triggers are outlined in Table 12. Tree based measurements would be conducted on a minimum of 10 permanently marked representative trees per site, spread across the site, with most trees located near to the main Creek channel. Site based measurements would be made from one permanent sampling point established at each site.

Whole of ecosystem monitoring using remote sensing is also highly recommended. GDV monitoring using high resolution satellite imagery is now becoming standard practice. With such imagery, GDV canopy can be identified and distinguished from non-GDV canopy; areas of GDV canopy that undergo significant change can then be detected across the entire Project area. This approach is supported by field based monitoring of sites and targeted ground truthing. When a remote sensing monitoring component is included, on-ground monitoring effort can generally be less intensive than if remote sensing is not included.

6.2.5 Data analysis, Interpretation and Reporting

Data would be analysed, interpreted and assessed against monitoring triggers with the aid of control charts (Gove et al. 2013). Reporting would be via an annual report that presents all relevant data in a

standard scientific format, and includes a discussion on evaluating performance against management targets, evaluates the effectiveness of the monitoring program, and provides recommendations on further investigations, management actions and revisions to the monitoring program if required. Ideally, a summary report card would also be prepared that simply indicates whether or not monitoring triggers have been exceeded, and includes a tally of the area of impact to GDV in relation to any approved areas of impact set out by legislation.

6.2.6 Roles and Responsibilities

Roles and responsibilities in relation to the monitoring program are listed in Table 13.

Table 12: Summary of proposed monitoring parameters for a potential expanded groundwater dependent vegetation (GDV) monitoring program for the Iron Valley Project. Also included is the scale at which parameters apply, the frequency of measurement and organisation responsible for data collection. Consult. = specialist GDV consultant.

Theme	Parameter	Method	Scale	Frequency	Who
GDV tree health	Visual health assessment	Souter et al. (2009; 2010)	Tree	Annual	Consult.
	Visual record	Digital photographs	Tree	Annual	Consult.
		Time lapse camera	Site	Daily	Consult.
	Tree height	Clinometer	Tree	Annual	Consult.
	Diameter at breast height	Tape measure	Tree	Start of monitoring	Consult.
	NDVI or derivative	Remote Sensing analysis of high resolution multispectral imagery (for example, WorldView)	Landscape	Annual	Consult.
Community composition and site condition	Vegetation condition classification	Keighery (1994)	Site	Annual	Consult.
	Site condition parameters: • GDV recruitment • weeds • understorey dieback • tree death • grazing impacts • surface water • evidence of recent fire • site photographs	Rapid visual assessments, simple abundance scale	Site	Annual	Consult.
Groundwater level	Depth to groundwater	Monitoring bores	Site	6 months	BC Iron
Climate	Rainfall, temperature and humidity	Weather station data from site or Bureau of Meteorology	Landscape	Daily	BC Iron

Table 13: Roles and responsibilities for a potential expanded groundwater dependent vegetation (GDV) monitoring program for the Iron Valley Project.

Role	Responsibility
BC Iron Environmental Manager	Co-ordinate implementation of the monitoring program, including liaison with relevant regulators as required
BC Iron Environmental Advisors	Implement the monitoring program
	Review monitoring reports and evaluate recommendations
	Initiate investigations as required
	Initiate management actions as required
	Oversee review and update of the monitoring program
	Oversee collection of groundwater and climate data
BC Iron Site Environmental Advisors	Supervise on-ground operations of mine operator (MRL)
	Supervise on-ground operations of GDV specialist consultant
	Supervise on-ground management actions
	Supervise collection of groundwater and climate data
GDV specialist consultant	Conduct on-ground monitoring
	Prepare monitoring reports

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Appendix C2 Flora and Vegetation Baseline

Iron Valley Project Flora and Vegetation Survey

February 2012

Report prepared for
URS Australia Pty Ltd on behalf of Iron Ore Holdings Ltd



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Iron Ore Holdings Ltd

Iron Valley Project – Flora and Vegetation Survey

Prepared for
URS Australia Pty Ltd

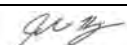
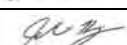
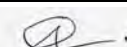
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Abbreviations and Definitions

Abbreviation	Definition
Astron	Astron Environmental Services
ANRA	Australian Natural Resources Atlas
BHPBIO	BHP Billiton Iron Ore
BIF	Banded Ironstone Formation
BOM	Bureau of Meteorology
DEC	Department of Environment and Conservation
DRF	Declared Rare Flora
DSEWPC	Department of Sustainability, Environment, Water, Population and Communities
EPA	Environmental Protection Authority
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
FMG	Fortescue Metals Group Pty Ltd
GDA	Geocentric Datum of Australia 1994
GDE	Groundwater Dependent Ecosystem
GIS	Geographical Information System
GPS	Global Positioning System
ha	Hectare/s
IBRA	Interim Biogeographic Regionalisation of Australia
IOH	Iron Ore Holdings Ltd
km	Kilometre/s
MGA	Map Grid of Australia
Mt	Million tonnes
Newman Aero	Newman Airport Weather Station
NVIS	National Vegetation Information System
PEC	Priority Ecological Community
TEC	Threatened Ecological Community
the Project	The Iron Valley Project
URS	URS Australia Pty Ltd
WAHERB	Western Australian Herbarium
*[species name]	Indicates species is not native to Western Australia

Executive Summary

Iron Ore Holdings Ltd (IOH) proposes to develop an iron ore mine on its Iron Valley tenement, located in the Eastern Pilbara Region, approximately 85 km north-west of Newman. In 2010, URS Australia Pty Ltd commissioned Astron Environmental Services on behalf of IOH to undertake a Level 2 Flora and Vegetation Survey of the Iron Valley Mining tenement (M47/1439), in accordance with the Environmental Protection Authority (EPA) *Guidance Statement No 51* and EPA *Position Statement No 3*. The survey objective was to record and assess the flora and vegetation across 1,102 hectares including the entire Iron Valley Mining tenement (M47/1439) and 17 hectares of Exploration Lease (E47/1385) to the west (the Survey Area). The proposed scope of works included a full identification of the flora and description of vegetation present within the Survey Area, including any species or communities of conservation significance. This report presents the findings of these surveys and the associated desktop research.

Qualified botanists completed two field survey trips between 8–19 April 2011, (during the summer wet season) and 25 July – 4 August 2011 (during the winter dry season); high rainfall preceded both surveys providing conditions conducive to high floristic diversity. The Survey Area was traversed by four-wheel drive vehicle and on foot. Colour aerial photography (1:10,000) was utilised to map vegetation boundaries. A total of 75 field sites were established comprising of 69 quadrats (50 m by 50 m or equivalent delineating a total area of 2,500 m²) and six relevés (unbounded sampling sites of a homogenous vegetation unit) in representative vegetation types across both topographical sequences and landforms, providing the basis for the vegetation classification.

A total of 238 vascular plant taxa, representing 40 families and 105 genera were recorded in the Survey Area. The dominant families were Fabaceae (51 species), Poaceae (43 species) and Malvaceae (31 species). No Declared Rare Flora or priority taxa were recorded during the survey. *Aristida hygrometrica* and *Senna curvistyla* are native to Western Australia but recordings as single occurrences in this survey indicate significant range extensions from the north and east respectively. Neither species is currently threatened or of conservation significance. Five introduced plant taxa, representing three families were identified. The most abundant and widespread of the introduced taxa recorded was **Cenchrus ciliaris* of the Poaceae family, commonly known as Buffel Grass.

The cover and density of dominant species were recorded and utilised in a non-parametric statistical analysis to describe typical vegetation associations for the Survey Area. Vegetation associations explicitly describe the dominant species and their cover within the ground, mid and upper strata of vegetation. Vegetation across the Survey Area was mapped to the vegetation association level in accordance with the National Vegetation Information System. Six vegetation associations were recorded across the Survey Area, with strong relationships to landform.

No Threatened Ecological Communities or Priority Ecological Communities were recorded in the Survey Area. However, the Survey Area is located 15–20 km downstream of the Priority 1 PEC Weeli Wolli Spring and west of Weeli Wolli Creek. Two key species (*Eucalyptus victrix* and *Corymbia hamersleyana*) are present in Groundwater Dependent Ecosystems (GDE) within the Survey Area. *Eucalyptus victrix* is classified as a facultative phreatophyte that will opportunistically use groundwater, whilst *C. hamersleyana* is a xerophyte and is not reliant on groundwater. The predicted depth to groundwater and drawdown cone of depression for the Survey Area indicates a potential for the phreatophytic vegetation to be affected by groundwater drawdown to some degree. Based on the sparse isolated numbers of *E. victrix* surveyed within GDE locations, it is recommended that a brief field survey focusing on GDE vegetation is undertaken to confirm the spatial diversity of *E. victrix* and determine if a GDE monitoring program is required.

The presence of **Cenchrus ciliaris* is the main concern for the biodiversity across the Survey Area, although it is sparse relative to other areas of the Pilbara. It has formed part of the lowest strata of a vegetation association on the plains areas and is highly invasive with high ecological impact. This risk will be magnified with continued disturbance of those areas. Conversely a small drainage area on the eastern margin of the Survey Area is relatively free of weed species, is dominated by native hummock grasses and *Eulalia aurea* tussock grasses, and is a tributary to the major drainage channel of Weeli Wolli Creek. A weed hygiene plan should be considered as a potential environmental management need for the Project, as the mining tenement is relatively small in area for the Pilbara Region and is in the Weeli Wolli Creek catchment.

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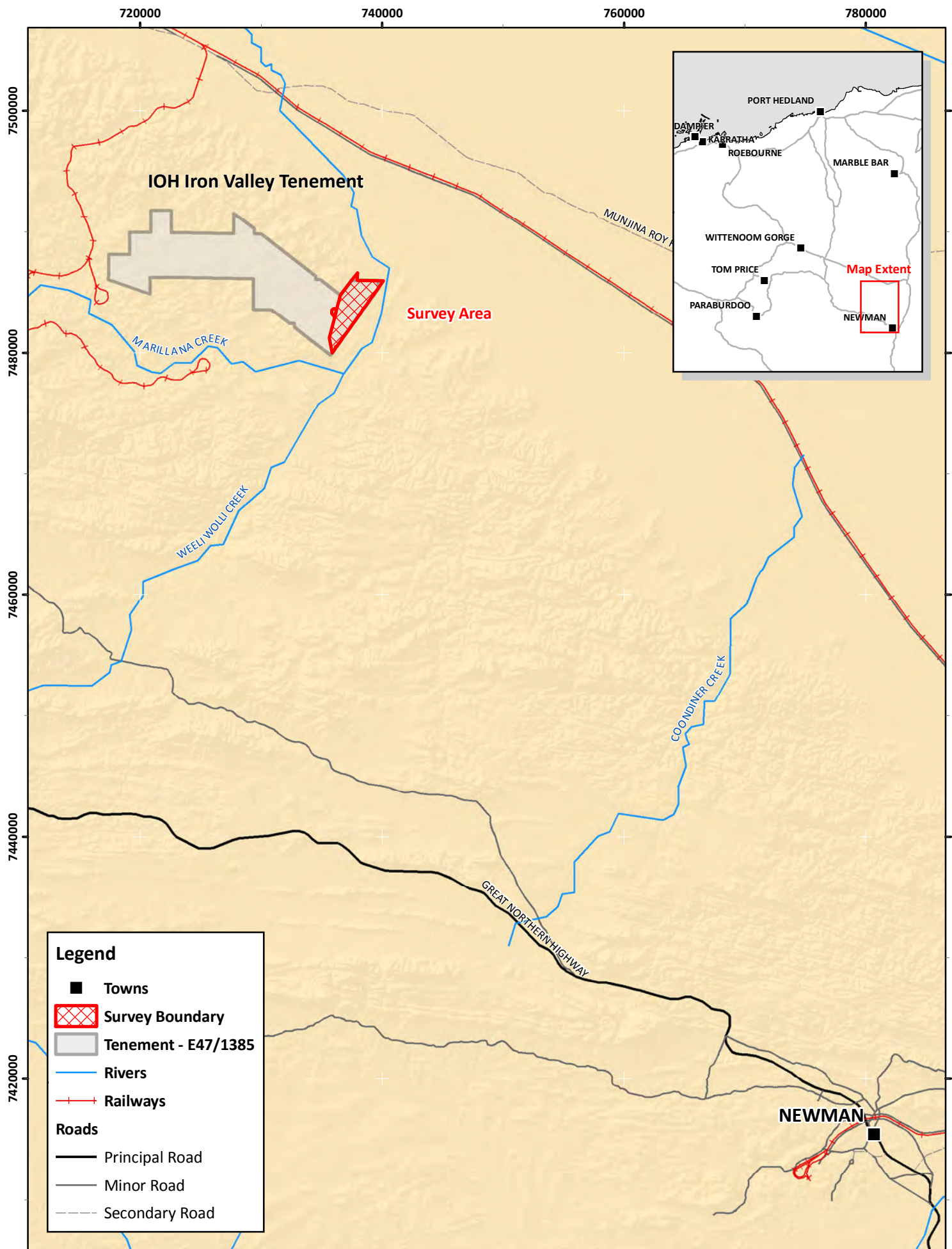
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1 Introduction

1.1 Project Background

Iron Ore Holdings Ltd (IOH) holds a number of tenements in the Central Pilbara region of Western Australia (IOH 2011). The Iron Valley Project (located on mining lease M47/1439, hereafter 'the Project') is located approximately 85 km northwest of Newman (Figure 1). The Project is located in close proximity to a number of operating iron ore mines, including Fortescue Metals Group's (FMG) Cloudbreak operation, Rio Tinto's Yandicoogina operation and BHP Billiton Iron Ore's (BHPBIO) Yandi operation. In 2010 Astron Environmental Services (Astron) was commissioned by URS Australia Pty Ltd (URS) on behalf of IOH to conduct a Level 2 Flora and Vegetation Survey in accordance with the Environmental Protection Authority (EPA) *Guidance Statement No 51* and EPA *Position Statement No 3*. This survey was conducted across an area of 1,102 ha (the Survey Area) comprising the entire Iron Valley Mining tenement (M47/1439) and 17 hectares of Exploration Lease (E47/1385).

Within the Survey Area, IOH has identified a high grade mineral resource which is part of the Brockman Iron Formation (IOH 2011). During the Survey period, IOH were undertaking Prefeasibility Phase 1 Studies at the Iron Valley tenement.



URS Australia Pty Ltd.
IOH Iron Valley Flora and Vegetation Surveys

Figure 1: Regional location of Survey Area

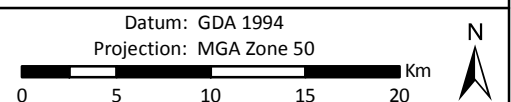


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Date: 03/09/2012

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1.2 Scope and Objectives

The scope of the Iron Valley Project, Flora and Vegetation Survey, included desktop research, field botanical surveys, data processing and reporting to be completed with the following objectives:

1.2.1 Desktop Research

A literature review and searches of environmental databases were undertaken to identify the following:

- Climate and regional context, including existing knowledge of vegetation, mapping, landforms and geology.
- Declared Rare Flora (DRF), Priority and Threatened flora recorded within a 50 km radius of the Survey Area;
- Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs) recorded within 5 km of the Survey Area;
- Any conservation areas, watercourses or Wetlands of National/International Importance within a 10 km radius of the Survey Area.

Definitions of the information researched in the databases are further described in Section 1.3.7.

1.2.2 Field Survey

A flora and vegetation survey was conducted within the Survey Area that incorporates the following:

- Installation of 69 permanent 50 m x 50 m quadrats (or of dimensions enclosing 2,500 m²) at predetermined survey sites. Where establishment of a permanent quadrat was not practical, relevé surveys were conducted with the GPS locations of the start and finish recorded;
- Within each quadrat and relevé, all vascular plant species, their height, cover and structural classes were recorded in accordance with Level 5 (species association) in the information hierarchy of the National Vegetation Information System (NVIS 2011). An 'association' is a vegetation specific term of the NVIS analogous to an ecological community. An ecological community is occurrence of populations of two or more different species within the same geographical area. In this report an association refers to an ecological community of two or more vascular plant species that also satisfies the Level 5 classification of the NVIS.
- Recording GPS locations of any DRF, Priority and other significant flora located within quadrats or recorded opportunistically;
- Recording GPS locations and abundance of any declared and noxious weeds identified within quadrats or recorded opportunistically;
- Recording vegetation condition and evidence of disturbance (including fire history and grazing) using the Vegetation Condition Scale of Keighery (1994);
- Collection and identification of vascular plant specimens in the field (where possible); and
- Vegetation mapping within the Survey Area consistent with Level 5 (species association) in the information hierarchy of the NVIS. Further information and discussion of the NVIS is given in Section 2.2.

1.2.3 Data Processing

After the field survey was completed, data and vascular plant specimens were collated in order to:

- Identify vascular plant material collected during the field survey to the lowest taxonomic level possible (where required, specialist botanists were utilised) to establish species richness and diversity of the Survey Area;
- Undertake vegetation mapping of the Survey Area and prepare maps utilising available spatial data of land systems, pre-European vegetation, vegetation associations, vegetation condition and locations of conservation significant flora and introduced taxa; and
- Conduct a pattern analysis to statistically analyse vascular plant data to define and delineate vegetation associations of the survey sites.

1.2.4 Report Preparation

A final report was prepared to communicate the following:

- Regional and contextual information (i.e. climate, land systems, pre-European vegetation);
- Methodology of the desktop research and field flora and vegetation surveys;
- Results of Department of Conservation and Environment (DEC) and Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) database searches;
- Descriptions of vegetation associations recorded in the Survey Area;
- A list of all vascular plant species recorded in the Survey Area;
- Location, distribution and abundance of any significant flora or introduced vascular plant species recorded;
- A discussion of the main results of the field survey;
- An assessment of the local and regional conservation value of the flora and vegetation recorded within the Survey Area;
- Addressing of any limitations of the flora and vegetation survey, seasonal or otherwise; and
- Identification of potential impacts on flora and vegetation and recommendations to minimise these.

1.3 Environmental Context

1.3.1 Climate

The Survey Area is located in the south eastern portion of the Pilbara Bioregion, dominated by a transitional arid to tropical climate with hot wet summers (October – April) and mild dry winters (May – September). Rainfall events are highly sporadic throughout the year and between years (Bureau of Meteorology (BOM) 2011) and high rainfall events are largely dependent on cyclonic activity (Payne and Tille 1992; ANRA 2009). The closest BOM weather station to the Survey Area is 92 km southeast at Newman Airport. Based on BOM (2011) records from 1971 to 2011 mean annual rainfall recorded by Newman Airport is 310.7 mm, approximately 68% of which fell during the summer months (Figure 2).

Temperature data has been recorded by BOM at the Newman Airport since 1996. The mean annual maximum temperature is 32.0°C and mean annual minimum is 16.1°C. The warmest months are November to March during which mean maximum temperatures exceed 35.0°C. The lowest daily minimum temperatures occur between June and August, where mean minimum temperatures are below 10.0°C.

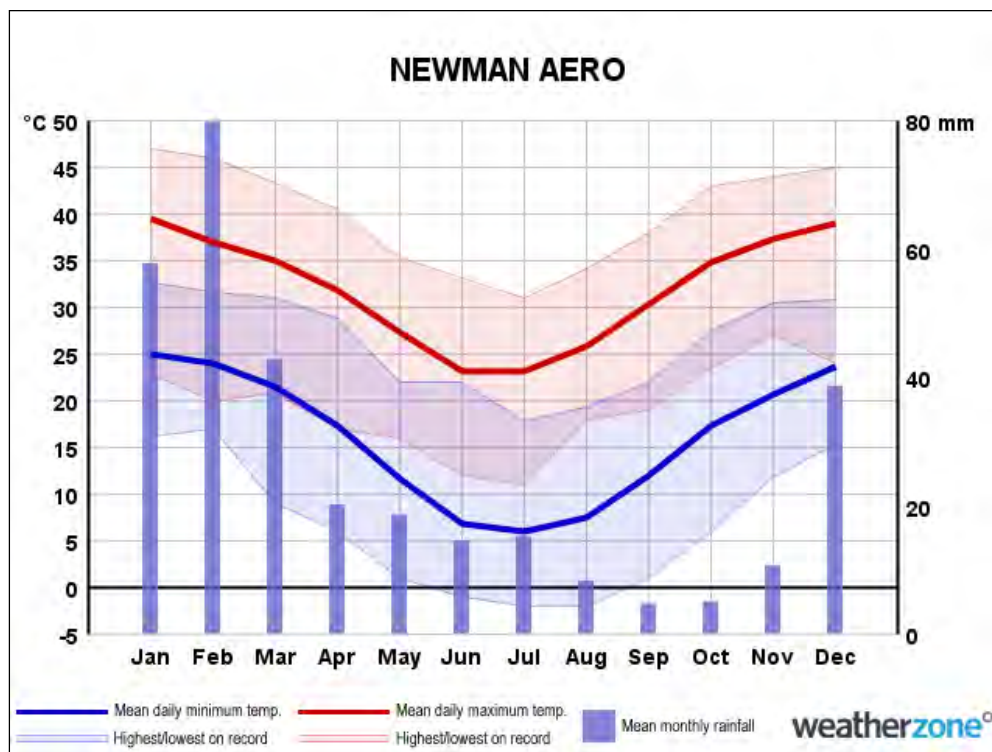


Figure 2: Climate averages and extremes for Newman Airport based on BOM records for rainfall 1971-2011 and temperature 1996-2011 (Weatherzone 2011).

1.3.2 Geology and Soils

The Survey Area is part of the Archaean Pilbara Craton, a geologically distinct region within the Pre-Cambrian Western Shield that has been stable for the past 2,400 million years (Trendall 1990). Iron Valley has been mapped and described on the Roy Hill 1:250,000 geological sheet (Thorne and Tyler 1997). The Survey Area is characterised by Banded Iron Formations (BIF) of the Brockman Iron Formation and the Weeli Wolli Formation of the Hamersley Group, bounded primarily by colluvium deposition and plains. Eolian deposition and alluvial drainage channels are also present in the Survey Area, but in comparatively minor proportions (<10%). The geology of the Survey Area is summarised in Table 1.

Table 1: Geology of the Survey Area (Thorne and Tyler 1997).

Description of Formation	Area (Ha) within Survey Area
Colluvium: partly consolidated quartz and rock fragments in silt and sand matrix; old valley-fill deposits	556.6
Brockman Iron Formation: banded iron-formation, chert and pelite	279.8
Weeli Wolli Formation: banded iron-formation (commonly jaspilitic), pelite, and numerous metadolerite sills	176.6
Alluvium: unconsolidated silt, sand, and gravel; in drainage channels and on adjacent floodplains	46.9
Eolian deposit: sand; in sheets and longitudinal dunes	41.6

The soils of the Survey Area are characteristic of the Hamersley Plateau physiographic unit, described by Beard (1975) as stony and shallow with occurrences of ferruginous duricrust where soil cover is extensively absent. Hilltops are typically characterised by shallow brown loams and sands with hard red soils occupying the lower slopes, while within valleys the alluvial plains are characterised by deep soils of earthy loams, cracking clays and earthy clays (Beard 1975).

More recently a single soil landscape zone has been mapped within the Survey Area by Tille (2006): the Hamersley Plateaux (Table 2). This soil landscape is characterised by stony soils on the uplands and red-brown non-cracking clays, red shallow loams and loamy earths on the footslopes and colluvial plains (Tille 2006).

Table 2: Soil landscape of the Survey Area (Tille 2006).

Soil Landscape Province	Soil Landscape Zone Code	Soil Landscape Zone Description
Fortescue	285 Hamersley Plateaux	Hills and dissected plateaux (with some stony plains and hardpan wash plains) on sedimentary and volcanic rocks of the Hamersley Basin (Ophthalmia Fold Belt). Stony soils with red shallow loams and some red-brown non-cracking clays and red loamy earths. Located in the Pilbara between Pannawonica, Newman and Paraburdoo.

1.3.3 Land Systems Mapping

Surveys of the rangelands within the Pilbara Region (van Vreeswyk *et al.* 2004) were undertaken on behalf of the (now) Department of Agriculture and Food, Western Australia. The land system mapping and survey provided a description of biophysical properties and resources within the region, as well as an evaluation of the soil and vegetation condition.

The Survey Area is equally composed of the Boolgeeda and Newman Land Systems (Table 3), the mapping of which is presented in Appendix A. Both land systems are widely represented in the Pilbara, constituting 7,748 km² (4.3%) and 14,580 km² (8.0 %) respectively of the entire Pilbara Region. The Boolgeeda Land System is associated with colluvial deposits of footslopes and pediments, typically supporting *Acacia aneura*, allied taxa (mulga) shrublands and *Triodia* spp. grasslands (van Vreeswyk *et al.* 2004). The Newman Land System is typical of upland formations with *Triodia* spp. grasslands, including plateaux, ridges and mountains (van Vreeswyk *et al.* 2004).

Table 3: Summary of Pilbara Land Systems located within the Survey Area (van Vreeswyk *et al.* 2004).

Land System	Landforms	Soils	Vegetation
Boolgeeda (Stony lower slopes and plains below hills)	Low hills and rises	Stony soils, red shallow loams	Hummock grassland of <i>Triodia</i> spp. with very scattered <i>Acacia</i> shrubs
	Stony slopes and upper plains	Stony soils, red shallow loams or red loamy earths	Hummock grassland of hard <i>Triodia</i> spp. or scattered shrubs of <i>Acacia aneura</i> , <i>A. ancistrocarpa</i> and other <i>Acacia</i> spp. with hard and soft <i>Triodia</i> ground layer
	Stony lower plains	Red loamy earths	Hummock grassland of hard <i>Triodia</i> spp. Also scattered / moderately closed tall shrubland of <i>Acacia aneura</i> with hard and soft <i>Triodia</i> ground layer
	Groves	Red loamy earths	Moderately closed woodland or tall shrubland of <i>Acacia aneura</i> with sparse low shrubs and tussock grasses
	Narrow drainage floors and channels	Red loamy earths and minor self-mulching cracking clays; channels with river bed soils	Scattered to closed tall shrublands / woodlands of <i>A. aneura</i> , <i>A. atkinsiana</i> and <i>Corymbia hamersleyana</i> with sparse low shrubs and hummock / tussock grassland
Newman (Rugged jaspilite plateau, ridges and mountains)	Plateaux, ridges, mountains and hills	Stony soils and red shallow loams with some red shallow sands	Hummock grassland of mixed hard <i>Triodia</i> with very scattered / scattered shrubs and trees including <i>Acacia</i> and <i>Senna</i> spp., <i>Grevillea wickhamii</i> , and mixed <i>Eucalyptus</i> . Occasionally soft hummock grassland
	Lower slopes	Stony soils on upper margins with red loamy earths on lower margins	Hummock grassland of mixed hard <i>Triodia</i> with very scattered / scattered shrubs and trees including <i>Acacia</i> and <i>Senna</i> spp., <i>Grevillea wickhamii</i> , and mixed <i>Eucalyptus</i>
	Stony plains	Stony soils with red shallow loams and some red loamy earths	Hummock grassland of hard <i>Triodia</i> with isolated / very scattered shrubs of <i>Acacia</i> and <i>Senna</i> spp., and occasional <i>Eucalyptus</i> trees. Occasionally soft <i>Triodia</i> hummock grassland

1.3.4 Interim Biogeographic Regionalisation for Australia

The Interim Biogeographic Regionalisation for Australia (IBRA, version 6.1) divides the Australian continent into 85 bioregions and 403 sub-regions (Thackway and Cresswell 1995). IBRA regions represent a landscape-based approach to classifying the land surface, including attributes of climate, geomorphology, landform, lithology, and characteristic flora and fauna. Specialist ecological knowledge, combined with appropriate regional and continental scale biophysical datasets, have been interpreted to define and describe these regions and subregions (Thackway and Cresswell 1995). According to the IBRA, the Survey Area is located within the Pilbara Bioregion and the Fortescue and Hamersley subregions (Table 4).

In 2003, the Pilbara Bioregion was identified by the Commonwealth Government as one of 15 regions in Australia worthy of priority conservation funding because of its high biodiversity values and high levels of threat to those values. The designation of this region as an Australian Biodiversity Hotspot gives recognition to the high level of species diversity, the presence of endemic taxa, the number of threatened taxa and the presence of fire-sensitive species and communities. In addition to bushfire, pressures from over-grazing, introduced taxa, and general land degradation were identified as significant threats to native biota in this region (DSEWPC 2010b). Approximately 5-10 % of the Pilbara Bioregion is represented in the national reserve system (DSEWPC 2010c).

The biodiversity of Western Australia's 53 subregions and their representation in the conservation estate was assessed as part of a national audit to provide priorities for reservation (DSEWPC 2010c). The two IBRA subregions within the Survey Area were described in these audits as follows:

- **PIL 2** – The Fortescue subregion is characterised by alluvial plains and river frontage. The alluvial plains of the east are dominated by an extensive salt marsh system, typically supporting grassland communities. The western (lower) drainage area is defined by deeply incised gorges. The subregion is recognised as the northern limit of *Acacia aneura* and related taxa (mulga). A significant calcrete aquifer supports the numerous permanent springs in the central Fortescue, characterised by large permanent wetlands with extensive stands of *Eucalyptus camaldulensis* (river gum) and *Melaleuca argentea* woodlands (Kendrick 2001a).
- **PIL 3** – The Hamersley subregion is characterised by dissected bold plateaux and ranges of flat lying or moderately folded sandstone and quartzite. Vegetation is described as *Acacia aneura* and allied taxa (mulga) low woodland over tussock grasses occurring on fine textured soils in valley floors, with scattered *Eucalyptus leucophloia* (snappy gum) over *Triodia brizoides* on skeletal soils of the ranges.

Table 4: IBRA subregions of the Pilbara Bioregion associated with the Survey Area.

IBRA sub region (Code)	Total in Survey Area (ha)
Fortescue (PIL 2)	945.7
Hamersley (PIL 3)	155.9

1.3.5 Flora and Vegetation

Beard (1975) mapped vegetation across the region at a scale of 1:1,000,000. Botanically the Survey Area is located in the Fortescue Botanical District of the Eremaean Botanical Province, which is further divisible into the Fortescue Valley and Hamersley Plateau physiographic units of Beard (1975). Both geographical units have a portion in the Survey Area. Beard's mapping of pre-European disturbed vegetation through the Survey Area is presented in Appendix A and summarised in Table 5.

The vegetation of the Fortescue Valley is described as *Acacia aneura* and allied species (mulga) low woodland. Most of the mulga is patchy in distribution and areas without trees are not uncommon. Additional species frequently found in the Fortescue Valley include *Acacia victoriae* and *A. tetragonophylla*.

The vegetation of the Hamersley Plateau is a tree steppe *Eucalyptus leucophloia* – *Triodia wiseana* association, representing a hummock grass cover interspersed with scattered low trees. There are few large shrubs, but a rich flora of small shrubs and herbs.

Table 5: Beard (1975) Vegetation Associations for the Survey Area.

Botanical unit	Beard Vegetation Association	Total Area within Survey Area (ha)	Vegetation Description
Fortescue Valley	29	952.4	Sparse low woodland, mulga (<i>Acacia aneura</i> and allies), discontinuous in scattered groups
Hamersley Plateau	82	149.3	Hummock grasslands, low tree steppe; snappy gum (<i>Eucalyptus leucophloia</i>) over <i>Triodia wiseana</i>

1.3.6 Flora and Vegetation Conservation Categories

Commonwealth and Western Australian regulatory agencies maintain databases of the locations and conservation status of significant ecological communities and flora species in Western Australia.

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a legal framework to protect and manage matters of national environmental significance including listed ecological communities and flora species. Listed ecological communities and flora species are allocated conservation categories which are outlined in Appendices B and C.

Under the Western Australian *Wildlife Conservation Act 1950*, a TEC is an ecological community that has been identified as being subject to processes that threaten to destroy or significantly modify it across much of its range. TECs are ranked under one of four categories as outlined in Appendix B.

DEC also maintains a list of PECs, to allow listing of communities that are possibly threatened or are not adequately defined and therefore do not meet the survey criteria for consideration as TECs. PECs are assigned one of four priority rankings according to the criteria outlined in Appendix B and require regular monitoring.

Under Western Australian legislation, all native flora are protected and it is an offense to 'take' native flora without a DEC license. To 'take' includes the removal of seeds or injuring plants. The *Wildlife Conservation Act 1950* also provides for native plant species to be specially protected

because they are under identifiable threat of extinction, are rare, or otherwise in need of special protection. These protected flora are considered under this Act to be threatened and are referred to as DRF.

Due to the diversity of Western Australia's flora, many species are known from only a few collections or locations, but have not been adequately surveyed. Such flora may be rare or threatened, but cannot be considered for declaration as threatened flora until adequate surveys have been undertaken. These flora are included on a supplementary conservation list called the Priority Flora list. Three categories of Priority Flora cover these poorly known species. A fourth category of Priority Flora includes species that have been adequately surveyed and are considered to be rare but not currently threatened. Western Australian flora conservation categories are detailed in Appendix C.

1.3.7 Weed Categories

The Australian Weed Strategy (NRMMC 2007) identifies 'Weeds of National Significance'. Weeds of National Significance are invasive with the potential to impact primary industry and/or environmental and social values.

The management of weeds in Western Australia is primarily regulated through the provisions of the *Agriculture and Related Resources Protection Act 1976*, and the *Biosecurity and Agriculture Management Act 2007*. A list of declared weed species has been gazetted under the *Agriculture and Related Resources Protection Act 1976*. Listed species are allocated one of five priority ratings which define the required level of management (Appendix D).

The Invasive Plant Prioritisation Process (DEC 2009) was developed to supersede the Environmental Weed Strategy for Western Australia (CALM 1999). The prioritisation process considers both a "species-led" and a "site-led" approach to priority setting for weed management on DEC managed lands. The prioritisation results for individual weeds within a DEC region should be utilised as a guide only and does not diminish any other requirements (statutory or otherwise) of land managers or developers.

1.3.8 Surface Water

The Project lies within the Weeli Wolli Catchment which drains into the Fortescue River Basin (known as the Fortescue Marsh) from Weeli Wolli Creek and Marillana Creek. The Project is located 15-20 km downstream of Weeli Wolli Spring and to the west of Weeli Wolli Creek. Weeli Wolli Spring (which feeds into Weeli Wolli Creek) has been highlighted as a significant arid wetland area, currently designated a Priority 1 PEC (see Appendix B and van Leeuwen 2009). Weeli Wolli Creek is characterised by unique phreatophytic flora and fauna communities, including taxa that are endemic to the area.

1.3.9 Land Tenure and Use

Pastoralism is the current land use for the Survey Area, which is located within the Marillana Pastoral Station. The Survey Area has a total area of 1,102 ha including all of Mining Lease M47/1439 (1,085 ha) and 17 ha of Exploration Licence E47/1385, which include the proposed sites for the accommodation village and village access road.

Marillana Creek is located south of the Iron Valley tenement and Weeli Wolli Creek is located to the east. Both these creeks are separated from the Iron Valley tenement by hills that run along the boundaries of the mining tenement.

2 Methodology

2.1 Desktop Research

2.1.1 Database Searches

Database searches were conducted to identify ecological communities and flora species categorised as being of conservation significance (see Appendices B and C) and possibly located within or within close proximity to the Survey Area. Search details are summarised in Table 6 with the results provided in Section 4.1.1.

Table 6: Database Searches conducted prior to field surveys.

Database Name	Date Search Results Received	Search Focus	Search Area
Protected Matters Search Tool (DSEWPC 2010a)	18 March 2011	Matters of National Environmental Significance including both listed ecological communities and flora species	10 km radius of coordinate -22°43' 55" S 119° 18' 42" E
DEC TECs and PECs Database (DEC 2011a)	8 March 2011	Listed Threatened and Priority Ecological Communities	5 km radius of coordinate -22°43' 55" S 119° 18' 42" E
DEC DRF and Priority Flora Database (DEC 2011b)	9 March 2011	Declared Rare and Priority Flora species	50 km radius of coordinate -22°43' 55" S 119° 18' 42" E
FloraBase (WAHERB 2011)			

2.1.2 Literature Review

A number of flora and vegetation surveys have previously been undertaken within 50 km of the Survey Area. Information from these reports was reviewed during the desktop research to provide an overview of the vegetation and to identify any potential species of interest.

- Biota Environmental Sciences (Biota) 2002, *'Hope Downs Rail Corridor, Port Hedland to Weeli Wolli Creek – Vegetation and Flora Survey. Baseline Survey'*, unpublished report for Hope Downs Management Services.
- Biota 2004a. *'Vegetation and Flora survey of the Proposed FMG Stage A Rail Corridor'*, unpublished report for FMG.
- Biota 2004b. *'Fortescue Metals Group Stage B Rail Corridor, Christmas Creek, Mt Lewin, Mt Nicholas, and Mindy Mindy Mine Areas'*, unpublished report for FMG.
- ENV Australia Pty Ltd 2007. *'Upper Marillana Exploration Lease: Flora and Vegetation Assessment'*, unpublished report for BHPBIO.
- Mattiske Consulting Pty. Ltd. (Mattiske), 2008a. *'Flora and Vegetation on the Hope Downs 4 Infrastructure Corridor'*, unpublished report for FMG.
- Mattiske 2008b. *'Flora and Vegetation Survey of Exploration Tenement E47/1237: Phil's Creek Project Area'*, unpublished report prepared for URS on behalf of IOH.

2.1.3 Seasonal Conditions

Plant species are dependent on adequate hydration for germination and survival. Rainfall was monitored prior to undertaking both surveys to gauge the appropriateness of undertaking a flora and vegetation assessment. The seasonal conditions experienced during the survey are described in Section 4.1.3.

2.2 Field Surveys

Two field survey trips to the Survey Area were conducted in accordance with the requirements for a Level 2 assessment outlined in the Environmental Protection Authority's (EPA) *Position Statement 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection* (2002) and EPA *Guidance Statement 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (2004). In essence a Level 2 biological survey requires one field survey in the main flowering season for the survey area and another in a different season.

The first field survey took place from the 8 to 19 April 2011, during the summer wet season. The team was led by Dr. Wendy Thompson (Senior Botanist), who is qualified and experienced in conducting Level 2 surveys. Natalie Cadd (Senior Environmental Scientist), Natalie Krawczyk (Graduate Botanist) and Clemency Wilson (Graduate Botanist) assisted in the field survey. During the first field survey 69 quadrats (50 x 50 m or 100 x 25 m) and six relevés (100-200 m in length) were established outside indigenous heritage areas, the distribution of all 75 survey sites is presented in Figure 3. Two quadrats (coded IOH30 and IOH32) were placed westward of the original delineated Survey Area to include an additional proposed infrastructure area (Figure 3), increasing the total Survey Area by 17 ha to 1,102 ha. The survey sites were selected with aerial photography to represent topographical, geomorphological and geological variation across the Survey Area. The sites capture the variation in flora and vegetation associated with the predominantly BIF uplands and associated colluvial slopes, pediments and alluvial drainage, encompassing a broad topological sequence.

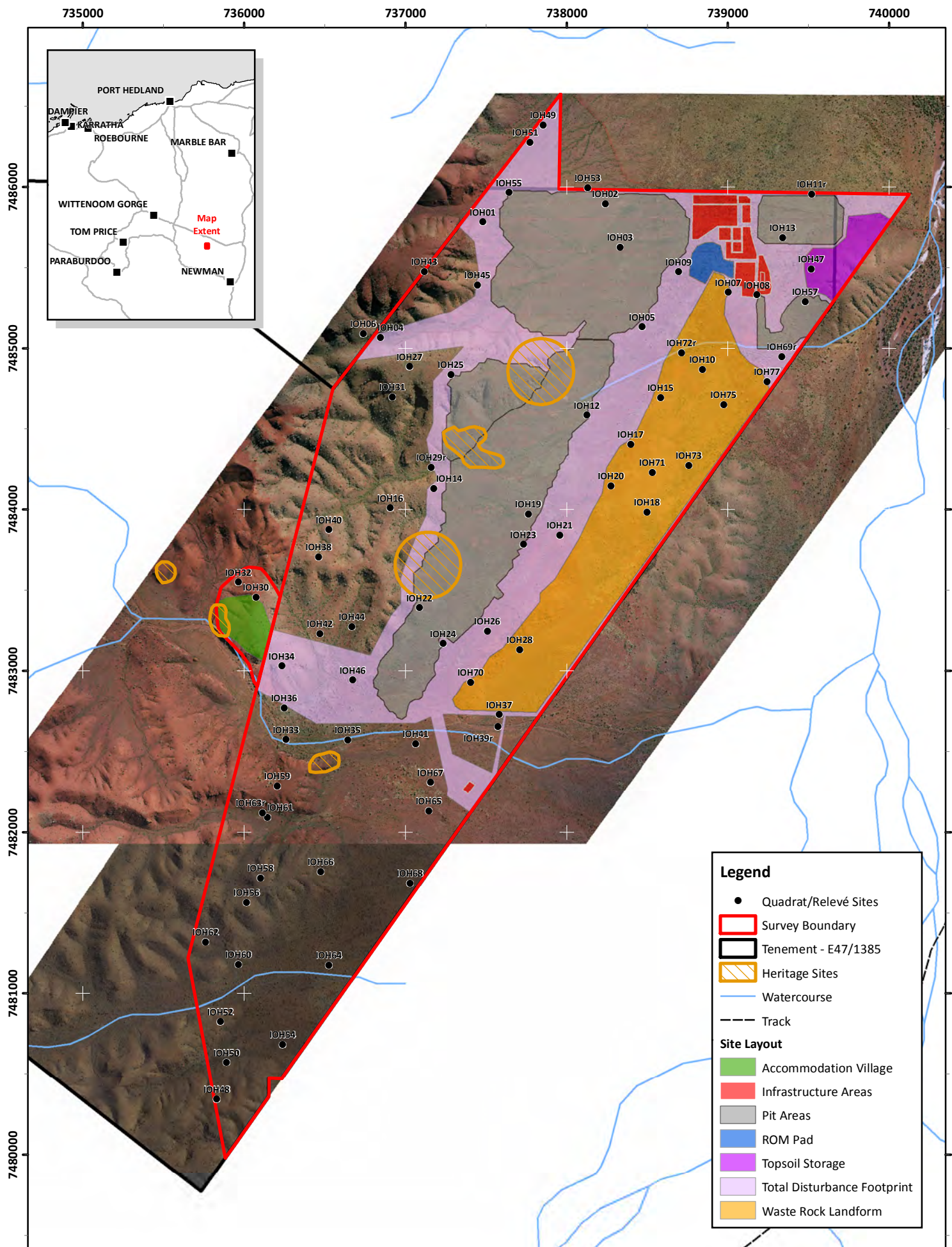
Vegetation associations were selected to represent minimal disturbance, however the Survey Area has experienced various levels of pastoral activities and also fire, which is a regular feature in the Pilbara Region. The most recent fire recorded in the Survey Area occurred in January 2009, which impacted the southern part of the Survey Area. Furthermore, exploration drilling activities have been undertaken across the Survey Area and drill pads and drill lines have been cleared throughout on both the valley floor and upslope areas.

A second field survey took place from 25 July - 4 August 2011, during the winter dry season. This survey was led by Dr. Wendy Thompson with Travis Doebling (Graduate Botanist) assisting. This second survey involved resurveying the quadrats and relevés established in the first field survey, in order to capture potential seasonal variation in floristic composition and cover.

The north-west, south-west, north-east and south-east corners of each quadrat were aligned with the aid of an optical square and the location of each corner was recorded with a handheld GPS and marked with a galvanized steel fence dropper. The coordinates of the start and finish of the relevés were recorded with a handheld GPS. Photographs of the vegetation profile of quadrats were taken for both field surveys from the north-west corner and likewise for relevés at both the start and finish.

The survey sites were coded and numbered on datasheets and in subsequent analyses as 'IOHXX' for a quadrat and 'IOHXXr' for a relevé. The following information was collected at each quadrat and relevé:

- **Location** – coordinates were measured using a handheld Garmin GPS (MGA50, GDA94). One set of coordinates were taken at a central location of each end of the relevé and one set of coordinates taken from each corner of every quadrat;
- **Recorder and Date** – a list of the personnel involved in sampling that location and the survey date;
- **Species** – all vascular plant species present including introduced species were recorded. Representative material was collected for verification and vouchering at the Western Australian Herbarium (WAHERB), with nomenclature recorded as defined in FloraBase (2011). Additional specimens were collected opportunistically, often adjacent to the quadrat, contributing to the overall species list for the Survey Area;
- **Weeds** – the species name, coordinates and density of any introduced flora was recorded;
- **Percent Foliar Cover** – the percentage cover was estimated for each species. Where foliar cover was less than 1%, a '+' was recorded on datasheets and in raw data (Appendix K);
- **Height** – the maximum height of each taxa was recorded;
- **Vegetation Description** – vegetation was described according to Aplin's (1979) modification of the vegetation classification system of Specht (1970) and the NVIS, Level 5 (Appendix E). At this level vegetation is described to 'association' where up to three dominant genera for each of the upper, mid and ground strata are categorised based on dominant growth form, cover and height (Cofinas and Creighton, 2001);
- **Vegetation Condition** – assessed according to the Vegetation Condition Classification of Keighery (1994, outlined in Appendix E);
- **Habitat** – a broad description of the surrounding landscape based on landform, topography and soil;
- **Disturbances** – records of any obvious disturbances such as fire, tracks or grazing; and
- **Photographs** – photographs of the vegetation profile were taken at the north-west corner of the quadrat and of the start and finish of each relevé.



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Figure 3A: Survey Area indicating quadrat and relevé locations

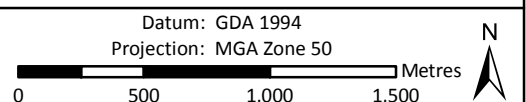


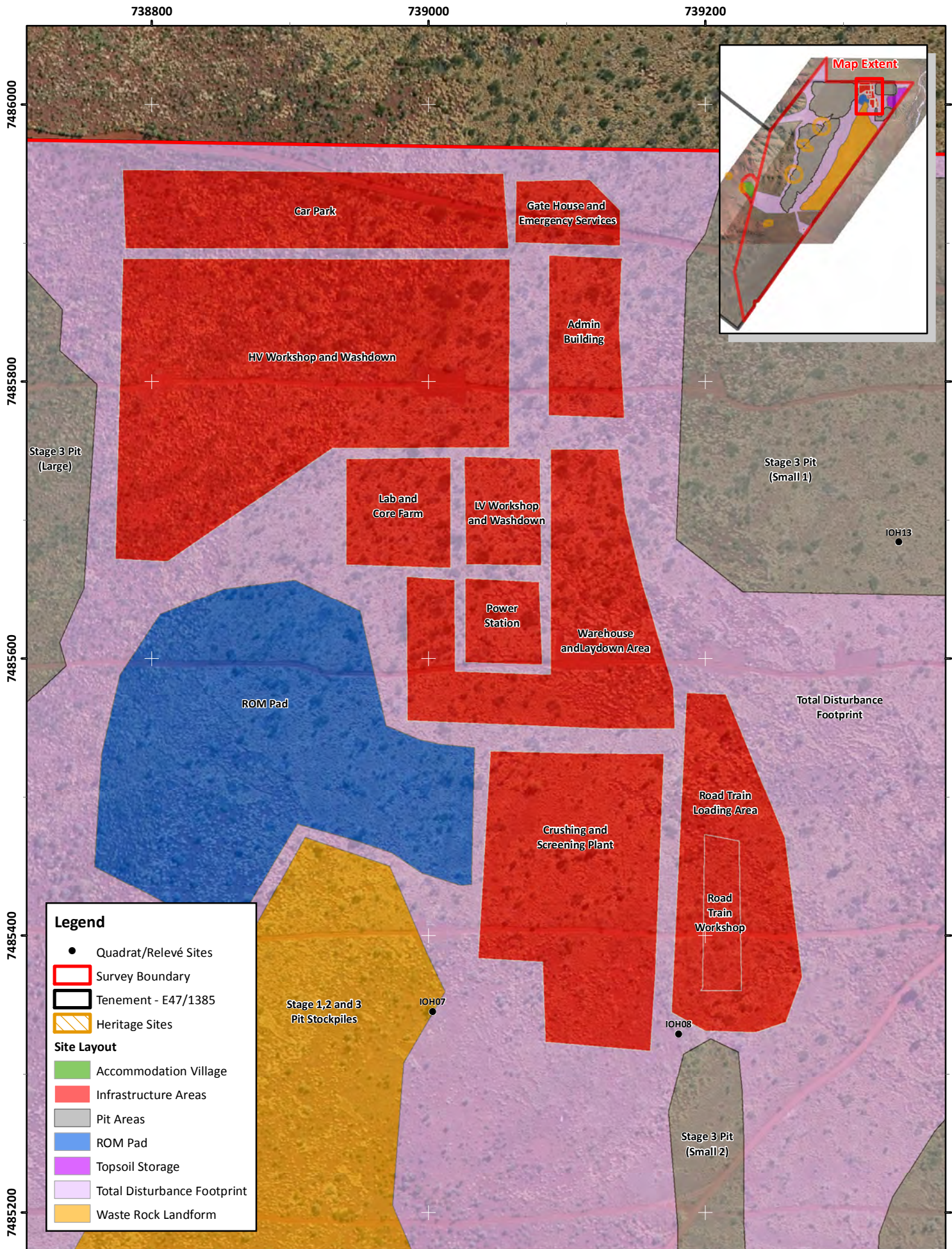
Author: W. Thompson

Date: 03-09-2012

Drawn: C. Dyde

Figure Ref: 3923-11FMV1RevB_20120903_Fig3A





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Figure 3B: Survey Area indicating quadrat and relevé locations

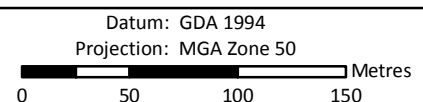


Author: W. Thompson

Date: 03-09-2012

Drawn: C. Dyde

Figure Ref: 3923-11FMV1RevB_20120903_Fig3B



2.3 Specimen Identification and Data Management

Vascular plant material was collected in the field for positive identification. Specimens were pressed, dried and identified by Astron botanists Dr. Wendy Thompson, Julie Fielder, Brian Vincent, Andrew Mitchell and Raimond Orifici, who are all highly knowledgeable of the Pilbara flora. Where required, specialist botanists were engaged for confirmation. In particular, Malcolm Trudgen assisted with specimens from the Malvaceae family, Ryonen Butcher (WAHERB) confirmed the *Tephrosia* (Fabaceae) material and Rob Davis (WAHERB) assisted with specimens of *Ptilotus* (Amaranthaceae). All specimens were identified to the lowest level of taxonomic classification possible and nomenclature followed WAHERB (2011). Data from the field assessment were entered into a customised Access database, developed by Ted Griffin.

2.4 Data Analysis

Classification of survey sites was determined utilising the hierarchical agglomerative technique, a pattern analysis which produces a dendrogram diagram displaying similarity between survey sites (Clarke and Warwick 2001). Cluster analysis of a species similarity matrix is a recognised method for describing species assemblages such as flora species associations, analogous to vegetation communities (Clarke and Warwick 2001).

The analysis was undertaken on a presence/absence data matrix of all confirmed species, sub-species and variants which occur at more than a single site (total of 75 survey sites). Annuals, singletons (taxa occurring at a single survey site) and indeterminate collections (unidentifiable specimens) were excluded from the analysis. The dissimilarity between sites was determined using the Bray-Curtis measure and the Resemblance routine in PRIMER v6 (Clarke and Gorley 2006). The Bray-Curtis measure is a widely-used assessment of ecological distance, which reflects compositional change (Legendre and Legendre 1998, Anderson and Robinson 2003), providing quantitative output for similarity between samples (Faith *et al.* 1987). The resulting dendrogram provided the framework for the vegetation associations and assigning survey sites to the particular groups (Appendix F). The clustering of the survey sites in the dendrogram was allied with particular landforms (i.e. hills, creeklines and plains) and within landforms (i.e. multiple plains, Vegetation associations); and aligned with field observations of vegetation patterns. Vegetation associations based on the clustering and field mapping were used to create the vegetation mapping imposed on 1: 10,000 colour aerial photographs of the Survey Area.

Vegetation associations were described based on Level 5 NVIS, where dominant taxa of three vegetation strata are presented. Delineation of vegetation associations were derived from clustering on the dendrogram and field knowledge of vegetation patterns. A single outlier occurred during the analyses, which was attributed to poor placement of the quadrat in a disturbed area and related depauperate (limited biodiversity) species richness. It was then assigned to the appropriate landform group.

Taxa within each vegetation association were determined utilising the similarity percentages (SIMPER) routine in PRIMER. The SIMPER analyses provided information on those species typically found within each vegetation association. The SIMPER routine determines those taxa contributing the greatest similarity within a vegetation association and dissimilarity amongst groups (Clarke and Warwick 2001). SIMPER reports both individual taxon contributions to the group as well as cumulative similarity within each group. Taxa contributing the greatest similarity within each vegetation association were reported up to 50% of the cumulative similarity. When several taxa had an equal similarity calculated at the 50% level, all taxa of that similarity level were reported. The taxa were then assigned to the appropriate strata in the vegetation structure.

3 Limitations

Limitations were identified during the survey and subsequent analysis and reporting, they are discussed in Table 7 as required by the EPA *Guidance Statement No 51* (EPA 2004).

Table 7: Survey Limitations.

Potential Limitation	Statement Regarding Potential Limitations
(i) Sources of information and availability of contextual information prior to the survey. Is the region well documented?	Broad contextual information is provided by IBRA (Kendrick 2001a and 2001b); Beard (1975) mapping; and land system classification and mapping (van Vreeswyk <i>et al.</i> 1994). Current condition and use of the landscape is documented primarily in grey literature, which has not been critiqued or assessed for accuracy.
(ii) Scope. The level of survey and detail required to undertake the survey. Was there adequate time to complete the survey to the desired standard of the EPA and DEC?	The time allocated to undertake the flora and vegetation surveys was sufficient.
(iii) Proportion of flora collected and identified. Was survey sampling, timing and intensity considered adequate? Was the survey conducted at what was considered an appropriate time of the year for plant identification? Were any taxonomic groups considered to be under-represented?	The surveys were conducted during April and July-August 2011. Field trips were scheduled to follow peak rainfall times in summer and winter. During months prior to and of the survey, rainfall was average or above average. Consequently in areas with low disturbance a very high number of specimens were collected. In particular, specimens collected during April 2011 were vigorous, healthy and mostly with flowers and/or fruit, aiding confident identification. This can be attributed to above average summer rains. Specimens collected during the July/August survey were also adequate to identify most to the species level. Very few collections within the <i>Triodia</i> group (Poaceae) were not identified to species level, as flowering heads were present on most specimens. Cattle grazing possibly reduced the floristic diversity and vegetation health of some areas of the Survey Area. In particular, in the portion of the Survey Area that had been burnt in 2009, the regeneration of the vegetation is likely to have been impacted by grazing pressure.
(iv) Completeness. Is there further work which may be required; i.e. was the relevant area fully surveyed?	A total of 73 sites were surveyed within Iron Valley Mining tenement (M47/1439) and 2 sites within the proposed infrastructure area of Exploration Lease (E47/1385). For the delineated Survey Area of 1,102 ha, it was surveyed at a rate of 1 quadrat/15 ha which is likely to have comprehensively represented all discrete units of vegetation, topography and soil type present.
(v) Mapping reliability. Were the aerial photographs, satellite images and site maps available considered adequate to fully understand the area surveyed? Was the mapping generated considered to have a high degree of reliability?	Colour aerial photography at 1:10,000 scale did not adequately represent current ground conditions, as a comprehensive drilling program was undertaken after the images were made; many quadrats had to be shifted from the original planned locations, particularly in the northern half of the Survey Area. As such the vegetation mapping represents the broad scale association that dominates the undisturbed areas of the northern Study Area but not the fine scale disturbed areas of drill pads and tracks.

Potential Limitation	Statement Regarding Potential Limitations
(vi) Disturbance. Had the Survey Area been impacted by any disturbance which may have limited the survey; i.e. fire, flood, accidental human intervention, etc?	The Survey Area has been impacted by livestock grazing, fire and exploration drilling that may have limited the plant species collected during the survey. As the Survey Area is part of a pastoral station, livestock are present at variable times and density. Old and fresh cattle dung was observed in the Survey Area during both trips. In the most recently burnt areas (at the southern end of the Survey Area in January 2009) post-fire grazing may have restricted vegetation regeneration. While above average rainfall prior to the survey meant that the sampling conditions were adequate, the post-fire succession may have variable species richness and diversity than what typically may be found in that area of the Survey Area. IOH has undertaken exploration drilling across the Project and have cleared drill line tracks and drill pads throughout the Survey Area. In the northern section of the Survey Area some west-east drill tracks, pads and associated clearing are less than 100 m apart, resulting in a less randomised distribution of 50 m x 50 m quadrats in those densely disturbed areas relative to other areas of the Survey Area. The presence of the drill lines and pads (and prior clearing) may have reduced the species richness and diversity present in adjacent survey sites.
(vii) Intensity. In retrospect, was the intensity considered to be adequate?	The survey intensity was appropriate for the topographical variation and size of the Survey Area.
(viii) Resources. Were the appropriate tools and materials available to complete the task effectively?	Adequate tools, materials and resources were available to complete the surveys, plant identification, data analyses and subsequent report writing.
(ix) Access. Were there any factors limiting access to the Survey Area?	No, the Survey Area was able to be traversed via vehicle, with the survey sites accessed by foot.
(x) Experience. Were personnel undertaking the field survey and plant identification trained and/or experienced in undertaking the required tasks?	The botanists responsible for undertaking the field surveys have considerable experience in conducting flora and vegetation surveys in the Pilbara. Similarly, the identification of specimens was conducted by personnel trained and experienced with identification of flora in the Pilbara region. Specialist taxonomists were used where required.

4 Results

4.1 Desktop Research

4.1.1 Database Search Results

A March 2011 search of the DEC Threatened Ecological Communities and Priority Ecological Communities database found no TECs or PECs to have been recorded within the Survey Area. Outside the Survey Area but within 5km of the search coordinate (22°43' 55" S, 119° 18' 42" E) the search identified two occurrences of the Priority 3 PEC 'Fortescue Valley Sand Dunes'. One occurrence is approximately 4 km north-northwest of the search coordinate at 22°43' 55.95" S, 119° 18' 11.61" E, and the second is at 22° 39' 25.67" S, 119° 18' 35.11" E, which is approximately 8.3 km north of the search coordinate. The buffer zone of 4.5 km around the PEC coordinate resulted in it being included in the search results. Three other occurrences of PECs occur within 30 km of the search coordinate: another of the Priority 3 'Fortescue Valley Sand Dunes', the Priority 1 'Fortescue Marsh (Marsh Land System)' and the Priority 1 'Weeli Wolli Spring Community' (Mia Podesta pers. comm.).

DPSEWPC and DEC database searches indicated that one species, *Lepidium catapycnon*, listed as DRF, and 41 Priority Flora species have been recorded within a 50 km radius of the Survey Area (DSEWPC 2010a and DEC 2011b). Based on habitat preferences, some of these species have the potential to occur within the Survey Area (WAHERB 2011). The Priority flora species with recorded occurrences within 50km of the Survey Area are presented in Table 8.

Table 8: Summary of DRF and Priority Flora listed in DEC Threatened Flora Database within 50 km of the Survey Area (DEC 2011b).

Species	Conservation Status	Life Form	Known Habitat Details	Likelihood of Occurrence
<i>Acacia aphanoclada</i>	Priority 1	Shrub	Rocky hills, ridges and rises.	Potential
<i>Acacia bromilowiana</i>	Priority 4	Tree or shrub	Red skeletal stony loam, orange-brown pebbly, gravel loam, laterite, banded ironstone, basalt. Rocky hills, breakaway, scree slopes, gorges, creek beds.	Potential
<i>Acacia cyperophylla</i> var. <i>omearana</i>	Priority 1	Tree or shrub	Stony and gritty alluvium, along drainage lines.	Potential
<i>Acacia effusa</i>	Priority 3	Shrub	Stony red loam, scree slopes of low ranges.	Potential
<i>Acacia fecunda</i>	Priority 3	Shrub	Quartzite gibbers over grey-red skeletal soil. Along shallow creeks and drainage lines, hills, road verges.	Potential
<i>Acacia</i> sp. Nullagine (B.R. Maslin 4955)	Priority 1	Shrub	Rocky clay. Low lying areas between rocky hills.	Potential
<i>Acacia subtiliformis</i>	Priority 3	Shrub	On rocky calcrete plateau.	Potential
<i>Amaranthus centralis</i>	Priority 3	Herb	Alluvial plains.	Potential

Species	Conservation Status	Life Form	Known Habitat Details	Likelihood of Occurrence
<i>Aristida jerichoensis</i> var. <i>subspinulifera</i>	Priority 1	Grass (tufted perennial)	Hardpan plains with deep soil.	Unlikely
<i>Aristida lazardis</i>	Priority 2	Grass (tufted perennial)	Sand or loam.	Potential
<i>Atriplex flabelliformis</i>	Priority 3	Herb (perennial)	Clay loam, loam. Saline flats or marshes.	Unlikely
<i>Atriplex spinulosa</i>	Priority 1	Herb (annual)	No data.	Potential
<i>Brachyscome</i> sp. Wanna Munna Flats (S. van Leeuwen 4662)	Priority 1	Herb (annual)	Low in landscape, plains. Depressions in cracking red brown clay or clay loam.	Unlikely
<i>Brunonia</i> sp. Long hairs (D.E. Symon 2440)	Priority 1	Herb	Along creeklines.	Potential
<i>Dampiera metallorum</i>	Priority 3	Herb	Skeletal red-brown gravelly soil over banded ironstone. Steep slopes, summits of hills.	Potential
<i>Eremophila magnifica</i> subsp. <i>velutina</i>	Priority 3	Shrub	Skeletal soils over ironstone. Summits.	Potential
<i>Eremophila spongiocarpa</i>	Priority 1	Shrub	Weakly saline alluvial plain on margins of marsh.	Unlikely
<i>Eremophila youngii</i> subsp. <i>lepidota</i>	Priority 4	Shrub	Stony red sandy loam. Flats and plains, floodplains, sometimes semi-saline, clay flats.	Unlikely
<i>Fimbristylis sieberiana</i>	Priority 3	Tufted sedge (perennial)	Mud, skeletal soil pockets. Pool edges, sandstone cliffs.	Unlikely
<i>Glycine falcata</i>	Priority 3	Herb (perennial)	Black clayey sand. Along drainage depressions in crabhole plains on river floodplains.	Unlikely
<i>Goodenia lyrata</i>	Priority 1	Herb	Red sandy loam. Near claypan.	Unlikely
<i>Goodenia nuda</i>	Priority 4	Herb (annual/ephemeral)	Creeklines, mulga (<i>Acacia aneura</i> and related taxa) areas and clayey plains, flood plains, drainage lines.	Unlikely
<i>Goodenia</i> sp. East Pilbara (A.A. Mitchell PRP 727)	Priority 3	Herb (annual/biennial)	Red-brown clay soil, calcrete pebbles. Low undulating plain, swampy plains.	Potential
<i>Indigofera gilesii</i> subsp. <i>gilesii</i>	Priority 3	Shrub	Pebbly loam amongst boulders and outcrops.	Potential
<i>Indigofera ixocarpa</i>	Priority 2	Shrub	Skeletal red soils over massive ironstone.	Potential

Species	Conservation Status	Life Form	Known Habitat Details	Likelihood of Occurrence
<i>Iotasperma sessilifolium</i>	Priority 3	Herb	Cracking clay, black loam. Edges of waterholes, plains.	Potential
<i>Lepidium catapycnon</i>	Threatened (DRF)	Herb or Shrub (woody perennial)	Skeletal soils. Hillsides.	Potential
<i>Myriocephalus scalpellus</i>	Priority 1	Herb	Clay. Depression on flood plain.	Unlikely
<i>Nicotiana heterantha</i>	Priority 1	Herb (annual/short lived perennial)	Black clay. Seasonally wet flats.	Unlikely
<i>Nicotiana umbratica</i>	Priority 3	Herb (annual/short lived perennial)	Shallow soils. Rocky outcrops.	Potential
<i>Oxalis</i> sp. Pilbara (M.E. Trudgen 12725)	Priority 2	Herb (annual)	Gullies and canyons. Brown-red loam, cobbles and pebbles.	Potential
<i>Rhagodia</i> sp. Hamersley (M. Trudgen 17794)	Priority 3	Shrub (perennial)	Red clay loam, mulga (<i>Acacia aneura</i> and related taxa), woodland, clay plains, flood plains.	Unlikely
<i>Rhynchosia bungarensis</i>	Priority 4	Shrub (prostrate)	Pebbly, shingly coarse sand amongst boulders. Banks of flow line in the mouth of a gully in a valley wall.	Potential
<i>Rostellularia adscendens</i> var. <i>latifolia</i>	Priority 3	Herb or Shrub	Ironstone soils. Near creeks, rocky hills.	Potential
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642)	Priority 3	Shrub	Skeletal red soils pockets. Steep slope.	Potential
<i>Stylidium weeliwolli</i>	Priority 2	Herb (annual)	Gritty sand soil, sandy clay. Edge of watercourses.	Potential
<i>Tecticornia globulifera</i>	Priority 1	Shrub	Flat floodplain, red clayey sand. Edge of salt lakes.	Unlikely
<i>Tecticornia medusa</i>	Priority 3	Shrub	Red clayey sand. Flat floodways, lake beds, saline alluvial plains, drainage sumps.	Unlikely
<i>Tephrosia bidwillii</i>	Priority 3	Shrub	Red sand gravel, red brown loam, silty sands. Valley, very gently inclined slope, alluvial plain or distal sheet flood fan.	Unlikely
<i>Themeda</i> sp. Hamersley Station (M.E. Trudgen 11431)	Priority 3	Grass (perennial)	Red clay. Clay pan, grass plain.	Unlikely
<i>Tribulus minutus</i>	Priority 1	Herb	Red sand.	Unlikely

Species	Conservation Status	Life Form	Known Habitat Details	Likelihood of Occurrence
<i>Triodia triticoides</i>	Priority 1	Grass	Rocky sandstone and limestone hillslopes.	Unlikely

4.1.2 Literature Review

Six flora and vegetation surveys have previously been conducted within 50 km of the Survey Area. A summary of the findings from these surveys is presented in Table 9. The survey location is an approximate distance between the closest survey site of the previous report to the current Survey Area as measured by the Australian Mines Atlas (Geoscience Australia 2011). Terminology of vegetation types is consistent with that used in the consultants' reports.

Table 9: Summary of results from previous surveys within 50 km of the Survey Area.

Consultant Report	Survey Location	Number of Sample Sites	Vegetation Recorded	Flora Recorded	Priority Flora Species Recorded	Introduced Species Recorded
Biota 2002. <i>Hope Downs Rail Corridor, Port Hedland to Weeli Wolli Creek – Vegetation and Flora Survey. Baseline Survey.</i> Unpublished report for Hope Downs Management Services.	30 km southwest of the Survey Area	286 quadrats	130 vegetation types	760 species, 70 families, 233 genera	Five P2: <i>Euphorbia clementii</i> , <i>Gonocarpus ephemerus</i> , <i>Indigofera ixocarpa</i> ms., <i>Ischaemum albobillosum</i> and <i>Olearia fluvialis</i> .	18 species : <i>Aerva javanica</i> , <i>Argemone ochroleuca</i> , <i>Bidens bipinnata</i> , <i>Cenchrus ciliaris</i> , <i>Cenchrus setiger</i> , <i>Citrullus colocynthis</i> , <i>Cucumis melo</i> subsp. <i>agrestis</i> , <i>Echinochloa colona</i> , <i>Eragrostis minor</i> , <i>Euphorbia hirta</i> , <i>Malvastrum americanum</i> , <i>Opuntia stricta</i> , <i>Setaria verticillata</i> , <i>Sigesbeckia orientalis</i> , <i>Solanum nigrum</i> , <i>Sonchus oleraceus</i> , <i>Stylosanthes hamata</i> and <i>Tridax procumbens</i> .

Consultant Report	Survey Location	Number of Sample Sites	Vegetation Recorded	Flora Recorded	Priority Flora Species Recorded	Introduced Species Recorded
Biota 2004a. <i>Vegetation and Flora survey of the Proposed FMG Stage A Rail Corridor.</i> Unpublished report for Fortescue Metals Group	30 km southeast of Survey Area	97 quadrats	122 vegetation types. No TECs or PECs	762 species 69 families 218 genera	Three P1: <i>Eremophila spongiocarpa</i> , <i>Goodenia omearana</i> , <i>Josephinia</i> ?sp. Marandoo (ME Trudgen 1554); Seven P2: <i>Euphorbia clementii</i> , <i>Gonocarpus ephemerus</i> , <i>Indigofera ixocarpa</i> ms., <i>Ischaemum albobillosum</i> , <i>Olearia fluvialis</i> , <i>Paspalidium retiglume</i> , and <i>Stylidium weeliwolli</i> ; Ten P3: <i>Abutilon trudgenii</i> ms., <i>Bulbostylis burbridgeae</i> , <i>Eriachne tenuiculmis</i> , <i>Goodenia nuda</i> , <i>Gymnanthera cunninghamii</i> , <i>Hibiscus brachysiphonius</i> , <i>Phyllanthus aridus</i> , <i>Polymeria</i> sp. Hamersley (ME Trudgen 11353), <i>Sida</i> sp. Wittenoom (WR Barker 1962), <i>Themeda</i> sp. Hamersley Station (ME Trudgen 11,431); One P4: <i>Goodenia stellata</i> .	11 species: <i>Aerva javanica</i> , <i>Bidens bipinnata</i> , <i>Cenchrus ciliaris</i> , <i>Cenchrus setiger</i> , <i>Chloris virgata</i> , <i>Citrullus colocynthis</i> , <i>Datura leichhardtii</i> , <i>Malvastrum americanum</i> , <i>Setaria verticillata</i> , <i>Solanum nigrum</i> , and <i>Stylosanthes hamata</i> .

Consultant Report	Survey Location	Number of Sample Sites	Vegetation Recorded	Flora Recorded	Priority Flora Species Recorded	Introduced Species Recorded
Biota 2004b. <i>Fortescue Metals Group Stage B Rail Corridor, Christmas Creek, Mt Lewin, Mt Nicholas, and Mindy Mindy Mine Areas.</i> Unpublished report for Fortescue Metals Group	45 km north-northeast of Survey Area	206 quadrats	81 vegetation associations. No TECs or PECs.	599 species 54 families 181 genera	One P1: <i>Eremophila pilosa</i> ; Five P3: <i>Abutilon trudgenii</i> ms., <i>Goodenia nuda</i> , <i>Hibiscus brachysiphonius</i> , <i>Sida</i> sp. Wittenoom (WR Barker 1962), and <i>Themeda</i> sp. Hamersley Station (ME Trudgen 11,431).	13 species: <i>Acetosa vesicaria</i> , <i>Aerva javanica</i> , <i>Argemone ochroleuca</i> ssp. <i>ochroleuca</i> , <i>Bidens bipinnata</i> , <i>Cenchrus ciliaris</i> , <i>C. setiger</i> , <i>Chloris virgata</i> , <i>Citrullus colocynthis</i> , <i>Echinochloa colona</i> , <i>Malvastrum americanum</i> , <i>Setaria verticillata</i> , <i>Sigesbeckia orientalis</i> , and <i>Sonchus oleraceus</i> .
ENV 2007. <i>Upper Marillana Exploration Leases Flora and Vegetation Assessment.</i> Unpublished report for BHP Billiton Iron Ore.	25 km west of Survey Area	40 quadrats, 43 relevés (total of 83 sites)	No associations recorded.	296 species 46 families 135 genera	One P2: <i>Olearia fluvialis</i> ; Three P3: <i>Polymeria</i> sp. Hamersley (M.E. Trudgen 11353), <i>Rostellularia adscendens</i> ssp. <i>adscendens</i> var. <i>latifolia</i> and <i>Goodenia pascua</i> .	4 species: <i>Cenchrus ciliaris</i> , <i>Malvastrum americanum</i> , <i>Bidens bipinnata</i> and <i>Cucumis melo</i> ssp. <i>agrestis</i> .
Mattiske 2008a. <i>Flora and Vegetation Survey of Exploration Tenement E47/1237: Phil's Creek Project Area.</i> Unpublished report prepared for URS Australia Pty Ltd on behalf of Iron Ore Holdings Ltd.	10 km west of the Survey Area	53 quadrats	10 vegetation associations. No TECs or PECs.	185 species 33 families 64 genera	One P3: <i>Euphorbia inappendiculata</i> .	1 species: <i>Cenchrus ciliaris</i> .

Consultant Report	Survey Location	Number of Sample Sites	Vegetation Recorded	Flora Recorded	Priority Flora Species Recorded	Introduced Species Recorded
Mattiske 2008b. <i>Flora and Vegetation on the Hope Downs 4 Infrastructure Corridor</i> . Unpublished report for Fortescue Metals Group	30km south-southeast of Survey Area	139 quadrats 87 relevés (total of 226 sites)	25 Vegetation associations. No TECs. One community with similarities to PEC: Weeli Wolli Springs Community (Priority 1).	392 species 54 families 155 genera	One DRF: <i>Lepidium catapycnon</i> ; One P1: <i>Rhagodia</i> sp. Hamersley (M.E. Trudgen 17794); Two P2: <i>Olearia fluvialis</i> , and <i>Stylidium weeliwolli</i> ; One P3: <i>Eremophila forrestii</i> ssp. <i>viridis</i> ; One P4: <i>Eremophila youngii</i> ssp. <i>lepidota</i> .	10 species: <i>Argemone ochroleuca</i> , <i>Bidens bipinnata</i> , <i>Cenchrus ciliaris</i> , <i>Chloris virgata</i> , <i>Portulaca oleracea</i> , <i>Setaria verticillat</i> , <i>Sonchus oleraceus</i> , and <i>Tribulus terrestris</i> (full list not given).

4.1.3 Survey Seasonal Conditions

The closest weather station to the Survey Area, Newman Airport, experienced 390.4 mm of rainfall in the 12 months preceding the initial field survey. In the 12 months preceding the second field survey the station recorded 427.6 mm of rain. Throughout this period there were a number of tropical lows and two cyclones with Tropical Cyclone Bianca in January 2011 and Tropical Cyclone Carlos in February 2011 generating high rainfall within the region. This resulted in the rainfall for February recorded at Newman Airport in to be approximately 64 mm above average (Figure 4), which provided good seasonal conditions for floristic diversity and plant health for the following two months during which the first field survey was conducted. Rainfall at Newman Airport in July 2011, preceding the second field survey in August, was recorded to be approximately 16 mm above average.

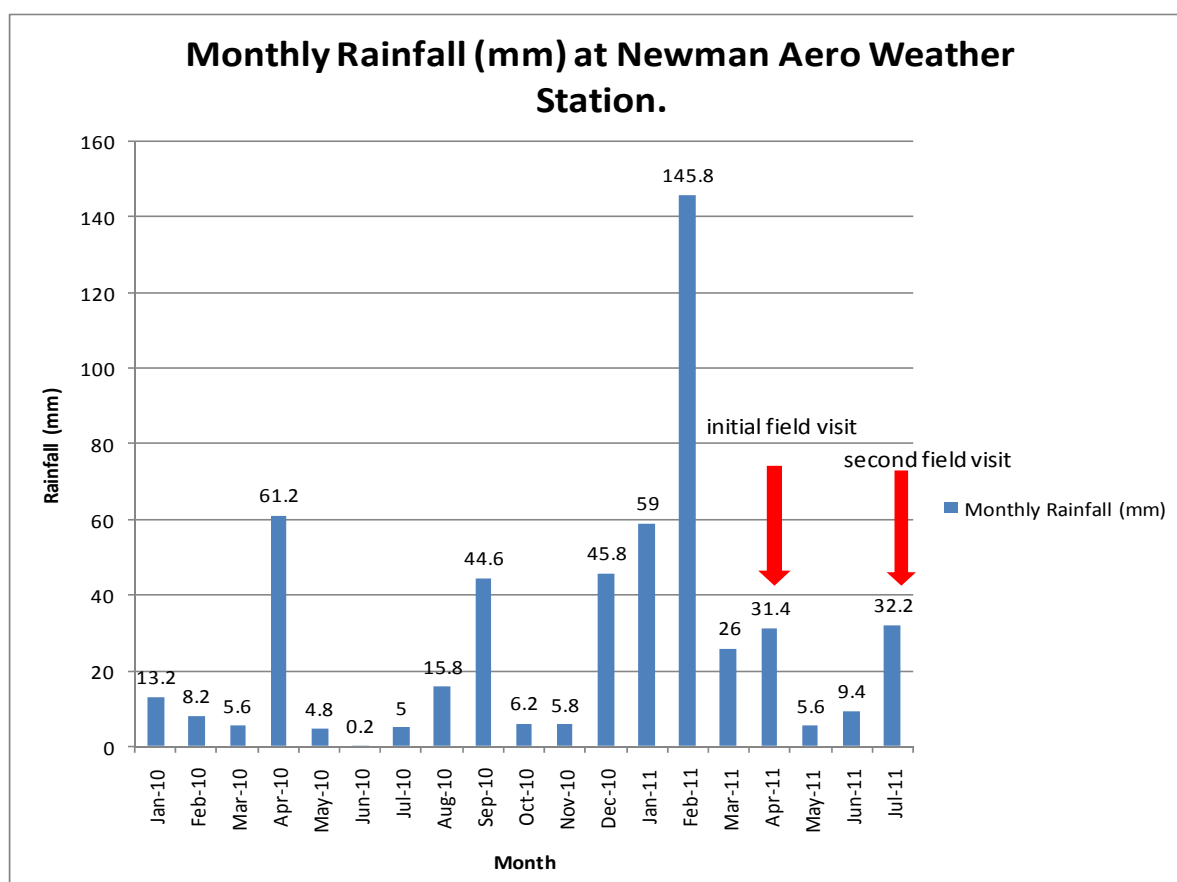


Figure 4: Monthly rainfall (mm) at Newman Aero Weather Station (Newman Airport) in the year preceding the field surveys (BOM 2011).

4.1.4 Field Survey

4.1.4.1 Flora Species Richness

A total of 238 vascular plant species from 40 families and 105 genera were identified, the species list is presented in Appendix G. The dominant families were Fabaceae (51 species), Poaceae (43 species) and Malvaceae (31 species). The genera with the highest species richness were *Acacia* (22 species), *Ptilotus* (12 species) and *Sida* (9 species). *Triodia* was a well-represented genus with seven distinct species and potentially three additional species groups, but which had insufficient material to provide definitive identification. Other well represented genera included *Senna*, with six different

species and six recognised subspecies and hybrids; and *Tephrosia*, with five distinct species, one recognised variant within the *T. rosea* group and a single affinity (*T. aff. supina*).

Species richness within the quadrats varied from 14 to 72 taxa, with an average richness of 41.6 ± 12.8 standard deviations per site. Species richness within the relevés varied from 28 to 42 taxa, with an average richness of 31.7 ± 5.3 standard deviations per site. Twenty-five taxa were amalgamated into 12 species complexes for analyses. There were a relatively low number of singleton taxa (i.e. occurring at just one survey site) with 35 taxa, including 10 annuals recorded. Fifty-one annuals were identified during the survey. The resulting matrix utilised in the classification analyses had 143 species by 75 sites. All annuals, singletons and indeterminate specimens were excluded prior to analyses to allow well defined grouping of vegetation associations for the purpose of vegetation mapping.

4.1.5 Conservation Significant Flora

Although DEC database searches identified 42 conservation listed plant taxa with the potential to occur in the Survey Area, the field survey did not identify any conservation significant taxa.

4.1.6 Groundwater Dependent Ecosystems

Two key species (*Eucalyptus victrix* and *Corymbia hamersleyana*) were surveyed within Groundwater Dependent Ecosystems (GDEs) or the Creek Line / Drainage Vegetation Descriptions as described in section 4.1.9.2. A brief desktop analysis of the predicted groundwater drawdown contours and the depths to groundwater (1 – 25 m) within the Survey Area suggest that *E. victrix* will have access to existing groundwater resources. The predicted groundwater drawdown (predicted over 7 years) ranges from 1 – 8 m and overlays creek and drainage lines that sustains *E. victrix* (Figure 5). However, the field survey identified isolated *E. victrix* in only one quadrat (IOH33) throughout the entire Survey Area.

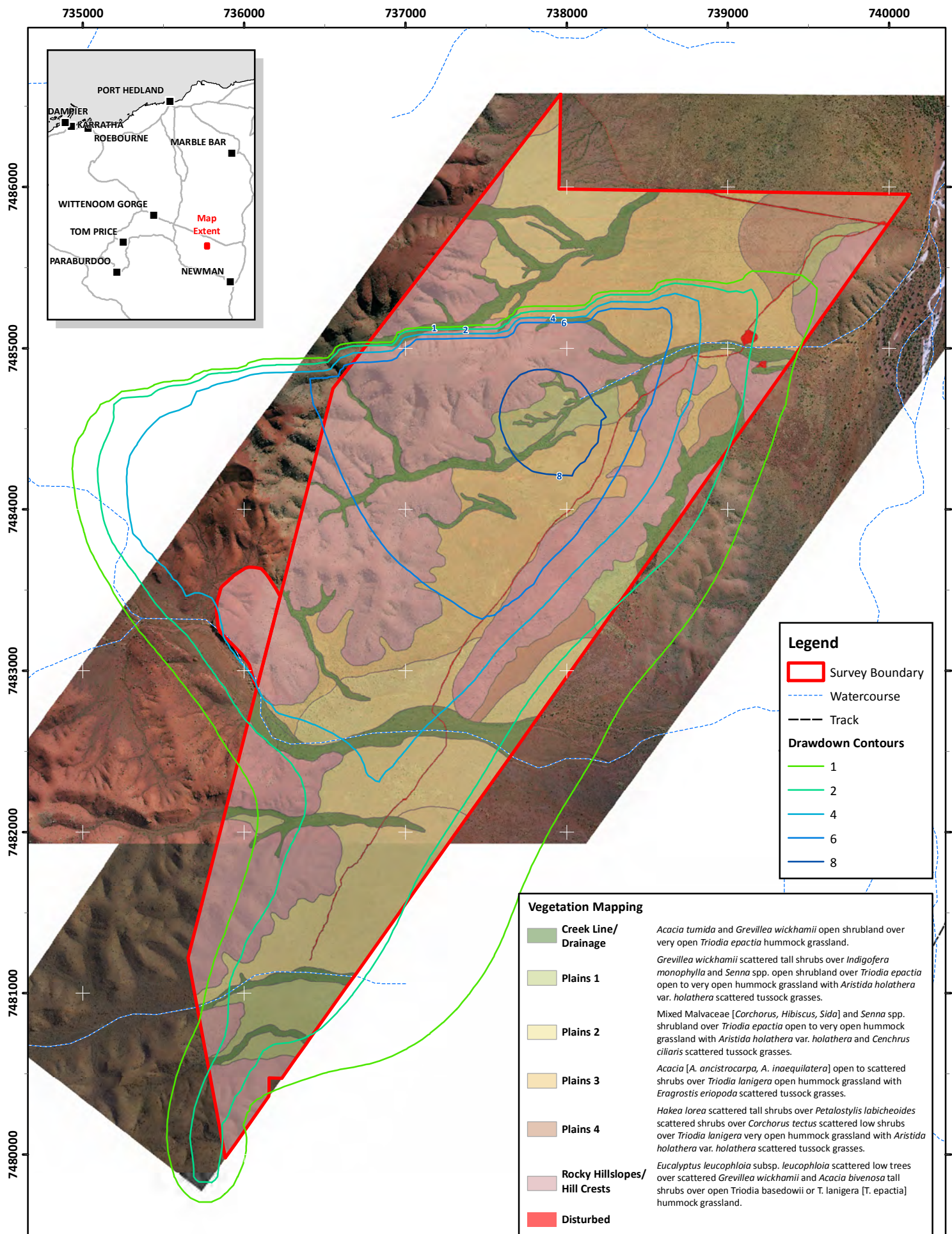
4.1.7 Range Extensions

Two range extensions were recorded during the survey (Appendix H). The collection of *Aristida hygrometrica* (Poaceae) from a single site (IOH09) is a significant range extension as the current distribution of this species is predominantly within the Kimberley Bioregion, with records extending to the Pilbara coastal area near Port Hedland (WAHERB 2011). The collection from this survey represents a range extension of approximately 275 km southwards. A single collection of *Senna curvistyla* (IOH23) represents a range extension of approximately 100 km westwards of its other known locations. These two species are further discussed in Section 5.

4.1.8 Introduced Flora

Introduced vascular flora species are recognised as occurring across the Pilbara region and are not uncommon. Five introduced plant species were identified (and WAHERB denotes introduced species with ‘*’ as a prefix), including: **Bidens bipinnata* (Asteraceae), **Cenchrus ciliaris* (Poaceae), **C. setiger*, **Portulaca oleracea* (Portulacaceae) and **Sonchus oleraceus* (Asteraceae).

Locations and abundance of introduced flora are outlined in Table 10. Information regarding the perceived level of threat in the Pilbara of each introduced flora species recorded in the Survey Area and a description of each species is presented in Appendix I. Of the recorded introduced species, **Cenchrus ciliaris* and **C. setiger* have the highest ecological impact and most rapid invasiveness (DEC 2009).



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Figure 5: Groundwater drawdown contours at Survey Area



Author: B. Powell

Date: 06-09-2012

Drawn: C. Dyde

Figure Ref: 3923-11FMV1RevB_20120906_Fig5

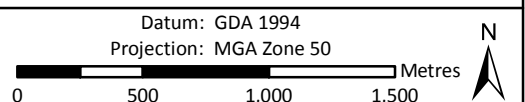


Table 10: Locations of Introduced Flora recorded in the Survey Area.

Species	Common Name	Family	Number of sites	Sites Recorded	Habitat Recorded
<i>*Bidens bipinnata</i>	Bipinnate beggartick	Asteraceae	1	IOH73	Narrow plain between low hills, possible floodplain in wet season
<i>*Cenchrus ciliaris</i>	Buffel Grass	Poaceae	22	IOH05, IOH08, IOH09, IOH24, IOH33, IOH35, IOH36, IOH37, IOH39r, IOH41, IOH42, IOH46, IOH47, IOH54, IOH60, IOH64, IOH65, IOH67, IOH69r, IOH72r, IOH73, IOH75	Open flat plain adjacent to shallow creek line between hills to the north and west
<i>*Cenchrus setiger</i>	Birdwood grass	Poaceae	7	IOH33, IOH35, IOH37, IOH65, IOH69r, IOH72r, IOH73	Shallow creek line and flat plains between hills to the north and west, possible floodplains in wet season
<i>*Portulaca oleracea</i>	Purslane	Portulacaceae	15	IOH04, IOH05, IOH09, IOH12, IOH17, IOH20, IOH21, IOH23, IOH24, IOH35, IOH41, IOH51, IOH53, IOH65, IOH67	Drainage valley running into generally open flat plain adjacent to shallow creek line, hills to the north and west
<i>*Sonchus oleraceus</i>	Common sowthistle	Asteraceae	1	IOH13	Open flat plain

4.1.9 Vegetation

4.1.9.1 Vegetation Classification

The vegetation of the Survey Area was classified with the NVIS information hierarchy (NVIS 2011) into three sub-formations (NVIS Level 4):

1. *Eucalyptus* scattered low trees over *Acacia* scattered shrubs over *Triodia* hummock grasslands on rocky hillcrests and slopes.
2. *Acacia* shrublands over *Triodia* hummocks and scattered tussock grasses in creeklines/drainage.
3. Mixed open shrublands (*Acacia*, *Corchorus*, *Grevillea*, *Senna*) over *Triodia* hummock grasslands and scattered tussock grasses on plains.

From the three sub-formations, six dominant vegetation associations (NVIS Level 5) were determined and used in the vegetation mapping of the Survey Area. The vegetation mapping reflects both vegetation classification and field mapping. The vegetation mapping is presented in Appendix J, with the field survey data presented in Appendix K. Representative survey quadrat and relevé photos are included in Appendix L. The site by species matrix used in the analysis is presented in

Appendix M. The vegetation associations are described below, organised by broad landform categories.

During the analyses, a single site (IOH77) occurred as an outlier on the cluster dendrogram. Upon review of the data, the site was determined to have been poorly placed, having been located on pre-existing disturbance and characterised by low species richness and cover. Based on field knowledge the position of the survey site was determined to fit in the 'Hills' vegetation classification and is treated on the vegetation mapping as such.

4.1.9.2 Vegetation associations

Rocky hillslopes / hill crest vegetation association:

<u>Hills</u>	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> scattered low trees over scattered <i>Grevillea wickhamii</i> and <i>Acacia bivenosa</i> tall shrubs over open <i>Triodia basedowii</i> or <i>T. lanigera</i> (<i>T. epactia</i>) hummock grassland.
Associated Species:	<i>Acacia adoxa</i> var. <i>adoxo</i> , <i>Aristida holathera</i> var. <i>holathera</i> , <i>Corchorus lasiocarpus</i> , <i>Goodenia stobbsiana</i> and <i>Ptilotus calostachyus</i> .
Quadrats:	IOH01, IOH10, IOH14, IOH15, IOH16, IOH18, IOH21, IOH22, IOH25, IOH26, IOH27, IOH30, IOH31, IOH32, IOH34, IOH38, IOH40, IOH43, IOH44, IOH45, IOH48, IOH50, IOH52, IOH56, IOH57, IOH58, IOH59, IOH62, IOH66, IOH70, IOH71, IOH77.
Total Area:	468.28 ha (42.49% of Survey Area).

Creeklines / drainage vegetation association:

<u>Creeks</u>	<i>Acacia tumida</i> and <i>Grevillea wickhamii</i> open shrubland over very open <i>Triodia epactia</i> hummock grassland.
Associated Species:	<i>Gossypium robinsonii</i> , <i>Polycarpaea longiflora</i> , <i>Themeda triandra</i> , and <i>Trichodesma zeylanicum</i> .
Quadrats/relevés:	IOH03, IOH04, IOH29r, IOH33, IOH35, IOH39r, IOH63r, IOH69r, IOH72r.
Total Area:	114.02 ha (10.35 % of Survey Area)

Plains vegetation associations:

Plains 1 *Grevillea wickhamii* scattered tall shrubs over *Indigofera monophylla* and *Senna* spp. open shrubland over *Triodia epactia* open to very open hummock grassland with *Aristida holathera* var. *holathera* scattered tussock grasses.

Associated Species: *Senna artemisioides* subsp. *helmsii*, *Senna artemisioides* subsp. *oligophylla* and *Senna artemisioides* subsp. *oligophylla* x *helmsii*.

Quadrats: IOH02, IOH06, IOH12, IOH47, IOH51, IOH53, IOH55.

Total Area: 57.44 ha (5.21 % of Survey Area).

Plains 2 Mixed Malvaceae (*Corchorus*, *Hibiscus*, *Sida* spp.) and *Senna* spp. shrubland over *Triodia epactia* open to very open hummock grassland with *Aristida holathera* var. *holathera* and **Cenchrus ciliaris* scattered tussock grasses.

Associated Species: *Acacia inaequilatera*, *Bonamia erecta*, *Corchorus tectus*, *Eragrostis eriopoda*, *Euphorbia australis*, *Grevillea wickhamii*, *Hibiscus sturtii* var. *platychlamys*, *Hybanthus aurantiacus*, *Indigofera monophylla*, *Senna artemisioides* subsp. *helmsii*, *S. artemisioides* subsp. *oligophylla* x *helmsii*, *S. notabilis* and *Trichodesma zeylanicum*.

Quadrats: IOH24, IOH36, IOH37, IOH41, IOH42, IOH46, IOH54, IOH60, IOH61, IOH64, IOH65, IOH67, IOH73.

Total Area: 194.03 ha (17.61 % of Survey Area).

Plains 3 *Acacia ancistrocarpa*, *A. inaequilatera* open to scattered shrubs over *Triodia lanigera* open hummock grassland with *Eragrostis eriopoda* scattered tussock grasses.

Associated Species: *Acacia adoxa* var. *adoxa*, *Bonamia erecta*, *Dicrastylis cordifolia*, *Euphorbia australis*, *Indigofera monophylla*, *Ptilotus calostachyus* and *Senna notabilis*.

Quadrats: IOH05, IOH07, IOH08, IOH09, IOH17, IOH19, IOH20, IOH23, IOH49, IOH68.

Total Area: 213.57 ha (19.38 % of Survey Area)

Plains 4 *Hakea lorea* scattered tall shrubs over *Petalostylis labicheoides* scattered shrubs over *Corchorus tectus* scattered low shrubs over *Triodia lanigera* very open hummock grassland with *Aristida holathera* var. *holathera* scattered tussock grasses.

Associated Species: *Bonamia erecta*, *Euphorbia australis* and *Senna notabilis*.

Quadrat/relevés: IOH11r, IOH13, IOH28, IOH75.

Total Area: 50.11 ha (4.55 % of Survey Area).

Disturbed Land: Additional areas of disturbed land with no definable vegetation association occupied a further 4.06 ha within the Survey Area (0.37%). These areas included the main access track, the exploration village, the lay-down yard, drill pads and drill lines and associated clearing within the Survey Area.

4.1.10 Vegetation Condition

Vegetation condition in the Survey Area varied from Good to Excellent, with one site being described as Fair and one as Poor/Partially Degraded in the vegetation condition scale of Keighery (1994). Sites classified as being in 'Excellent' condition contained predominantly native plant taxa, had few introduced taxa, were structurally intact and had not undergone significant disturbance. Survey sites considered in 'Fair' condition had very obvious signs of disturbance, reduced proportion of native plant taxa and up to 50% cover of introduced species.

Disturbance present in the Survey Area included livestock grazing, fire, presence of infrastructure (i.e. tracks and the exploration village), drill pads and spread of weed taxa such as **Cenchrus ciliaris* and **Cenchrus setiger*. However because much of the drilling disturbance occurred after the aerial photography provided was taken, it could not be included at an accurate scale in the vegetation mapping presented in Appendix J.

A wildfire occurred within the Project Area in January 2009, impacting the southern portion of the Survey Area. Evidence of the fire was obvious at the time of the survey, with some of the post-fire Vegetation associations on the flats varying in structure and composition from adjacent unburnt areas.

4.1.11 Conservation Significant Vegetation

No TECs or PECs or similar vegetation and landscape position combinations were recorded within the Survey Area.

5 Discussion

The six vegetation associations recorded in this survey correspond to the landscape features within the Survey Area. The output of the hierarchical agglomerative technique indicates a high similarity between sites within habitats (Appendix F) and coincided with the vegetation mapping undertaken in the field (Appendix J). Both the statistical analysis and vegetation mapping indicate distinct changes in species compositions across the 1,102 ha of the Survey Area and ecotones (transitional spatial boundaries between two different ecological communities) between the vegetation associations were minimal. Overall, the vegetation associations correspond with the topography and geology of the Survey Area.

Upslope and hilltop areas were relatively homogenous in species and representative of common slope compositions of the Pilbara, with scattered *Eucalyptus leucophloia* subsp. *leucophloia* trees over *Triodia* grasses dominant (Beard 1975; Hill and Johnson 2000). Lower in the landscape, the plains areas of the Survey Area were moderately disturbed and therefore the differing associations within the plains areas correspond to differing levels of soil degradation, fire and weed disturbance.

Only the 'Plains 2' association of the north-west corner and south-east of the Survey Area seemed affected by weed invasion, with scattered **Cenchrus ciliaris* forming the lowest strata with scattered *Aristida holathera* var. *Holathera* and *Triodia epactia* open hummock grassland. At the time of the field surveys **Cenchrus ciliaris* invasion of the 'Plains 2' association was relatively sparse and did not significantly affect the 'Plains 3' association, nevertheless weed dispersal may have been exacerbated in the north-west corner of the Survey Area by drill pad and drill line clearing. Such clearing was much less evident than fire disturbance in the south-east of the Survey Area, but similarly destructive physical disturbance to taller shrub and tree species seems to have allowed smaller to medium sized Malvaceae shrubs and **Cenchrus* spp. tussock grasses to form dominant strata.

In the long-term, invasion of **Cenchrus ciliaris* has the potential to reduce herbaceous species richness in arid and semi-arid environments of Australia with a greater effect than that resulting from insufficient rainfall (Jackson 2005; Clarke *et al* 2005). Also present is a risk of **Cenchrus ciliaris* seed dispersal from the 'Plains 2' communities of the south-east of the Survey Area into adjacent tributaries to Weeli Wolli Creek, transporting the highly invasive weed downstream. All major ephemeral water courses are classified as 'at risk' and Vulnerable in the Hamersley subregion (Kendrick 2001b). Of the five introduced weed species, **Cenchrus ciliaris* was recorded at the most sites (22) and has the highest impact rating and highest invasiveness rating according to DEC (2009; Appendix I), with similar ratings for **C. setiger*, the third most abundant weed species by site (7 sites). The other three weed species recorded are either low or negligible in their ecological impact (**Sonchus oleraceus* and **Portulaca oleracea* respectively) or very low in abundance (**Bidens bipinnata* was recorded at one site). Though occurrences are sparse relative to other areas of the Pilbara, a weed hygiene plan for the Project may restrict any further **Cenchrus* spp. or **Bidens bipinnata* invasion during further exploration and development activities.

On the eastern portion of the Survey Area, an area of drainage vegetated by the 'Creeks' association had quadrats dominated by *Triodia* spp. (IOH18 and IOH71) and one dominated by a native tussock grassland of *Eulalia aurea* (IOH73), with little presence of **Cenchrus ciliaris* or **C. setiger* (see Appendices J, K and Figure 3). Avoiding disturbance to such a relatively healthy, intact drainage area would be beneficial for the flora diversity of the area and also because of its close proximity to Weeli Wolli Creek.

Due to the importance of the Priority 1 PEC of Weeli Wolli Spring and the location of the Survey Area 15-20 km downstream of this PEC, a closer examination of GDEs and the presence of phreatophytic

vegetation was conducted. The field survey identified two key species in the GDE; *Eucalyptus victrix* and *Corymbia hamersleyana*. *Eucalyptus victrix* was identified at one quadrat location (IOH33) within the Survey Area and is classified as a facultative phreatophyte that will preferentially utilise stored soil water and then opportunistically use groundwater during times of limited rainfall or drought-like conditions (O’Grady *et al* 2002; Maunsell 2006; Astron 2008; Astron 2010). The other key species, *C. hamersleyana*, was present at a greater density within the GDE Survey Area, however its groundwater dependence is low and is therefore classified as a non-phreatophyte (xerophyte) (Astron 2010).

Based on the predicted groundwater depth, drawdown and likely associated impacts to the phreatophytic vegetation further analysis on the GDE and the phreatophytic vegetation is recommended. Due to the isolated numbers of *E. victrix* it is recommended that a brief field visit that focuses on GDE vegetation is undertaken to confirm the spatial diversity of *E. victrix* and determine if a GDE monitoring program is required.

Within the ‘Plains 3’ association, the most extensive of the Survey Area, two species were recorded significantly outside their previously recorded ranges. The current distribution of *Aristida hygrometrica* is mostly north of latitude 20°S (WAHERB 2011, AusGrass 2011) and the occurrence in the Survey Area represents a range extension of approximately 275 km south from the closest confirmed recording (WAHERB 2011). The single collection of *Senna curvistyla* (quadrat IOH23) represents a range extension of approximately 100 km west, although the current distribution of *S. curvistyla* is disjunct, with specimens primarily recorded from Gibson Desert, northern and far south-eastern Pilbara and Little Sandy Desert (WAHERB 2011). *Senna curvistyla* has previously been recorded in red soils and has been observed to regenerate quickly after fire (Randall 1989). Similar soil conditions are present and a recent fire age (2-5 years) was observed where it was recorded in the Survey Area. Neither species are considered threatened, yet these range extensions do suggest stronger dispersal capabilities of *Aristida hygrometrica* and *Senna curvistyla* than previously understood.

No Declared Rare Flora or Priority Flora species or assemblages of formal conservation significance were recorded, although *Acacia aptaneura* (a variety of Mulga, conservation status is not threatened) was recorded at one site within the ‘Plains 2’ vegetation association (IOH65). Mulga is both the common name given to a number of tall, woody, perennial arid zone species, and the name used for the vegetation types dominated by these species. The taxonomy of Mulga in Western Australia has recently undergone a revision and as a result fifteen species of Mulga have been described (Maslin and Reid 2009). The ecological requirements of individual Mulga species is relatively unknown, yet it is recognised that Mulga communities are often species rich and important areas for capturing, retaining and cycling sediments, nutrients and water (Maslin and Reid 2009). However, the occurrence of *Acacia aptaneura* in this survey represented <1% cover in a single quadrat and therefore is most likely an intrusive occurrence into the Malvaceae association of that site.

6 Conclusions

This flora and vegetation survey involved two field surveys, one in the summer wet season and another approximately four months later in the winter dry season of the Pilbara region, and rainfall was average to above average preceding both. Environmental conditions were conducive to high species richness and a total of 238 vascular plant species from 40 families and 105 genera were identified. The dominant families were Fabaceae (51 species), Poaceae (43 species) and Malvaceae (31 species). Though one DRF and 41 Priority species had been previously recorded within 50 km of the Survey Area, none were recorded in this survey.

The adjacent Weeli Wolli Priority 1 PEC resulted in a closer examination of the diversity and distribution of phreatophytic vegetation within the Survey Area. *Eucalyptus victrix* was sparsely located at one quadrat within the Survey Area. Based on the predicted groundwater depth, drawdown and likely associated impacts to the phreatophytic vegetation, a brief field visit that focuses on GDE vegetation is recommended to confirm the spatial diversity of *E. victrix* and determine if a GDE monitoring program is required.

Two species recorded indicate significant range extensions from approximately 275 km north and 100 km east, those being *Aristida hygrometrica* and *Senna curvistyla* respectively. A single occurrence of *Acacia aptaneura*, a species of Mulga, was recorded in this survey but is most likely an intrusive recruitment within the Malvaceae dominated association of that site.

Six vegetation associations were determined to occur in different hillslope, plains and riparian zones of the survey area with minimal transitional compositions between them. No TECs or PECs or similar community-landform combinations were recorded. An association recorded on the north-west and south-east plains of the Survey Area has scattered **Cenchrus ciliaris* tussock grasses as the dominant ground stratum. **Cenchrus ciliaris* is the only one of the five recorded weed species to have a high ecological impact in the Pilbara and significant abundance in the Survey Area. A drainage area on the eastern side of the Survey Area has dominant native hummock and tussock grasslands that are relatively free of **Cenchrus* spp. invasion. Therefore to maintain floristic diversity of the Survey Area and downstream areas of Weeli Wolli Creek, this report recommends avoiding disturbance to these eastern drainage areas in conjunction with implementing a weed hygiene plan for the Project.

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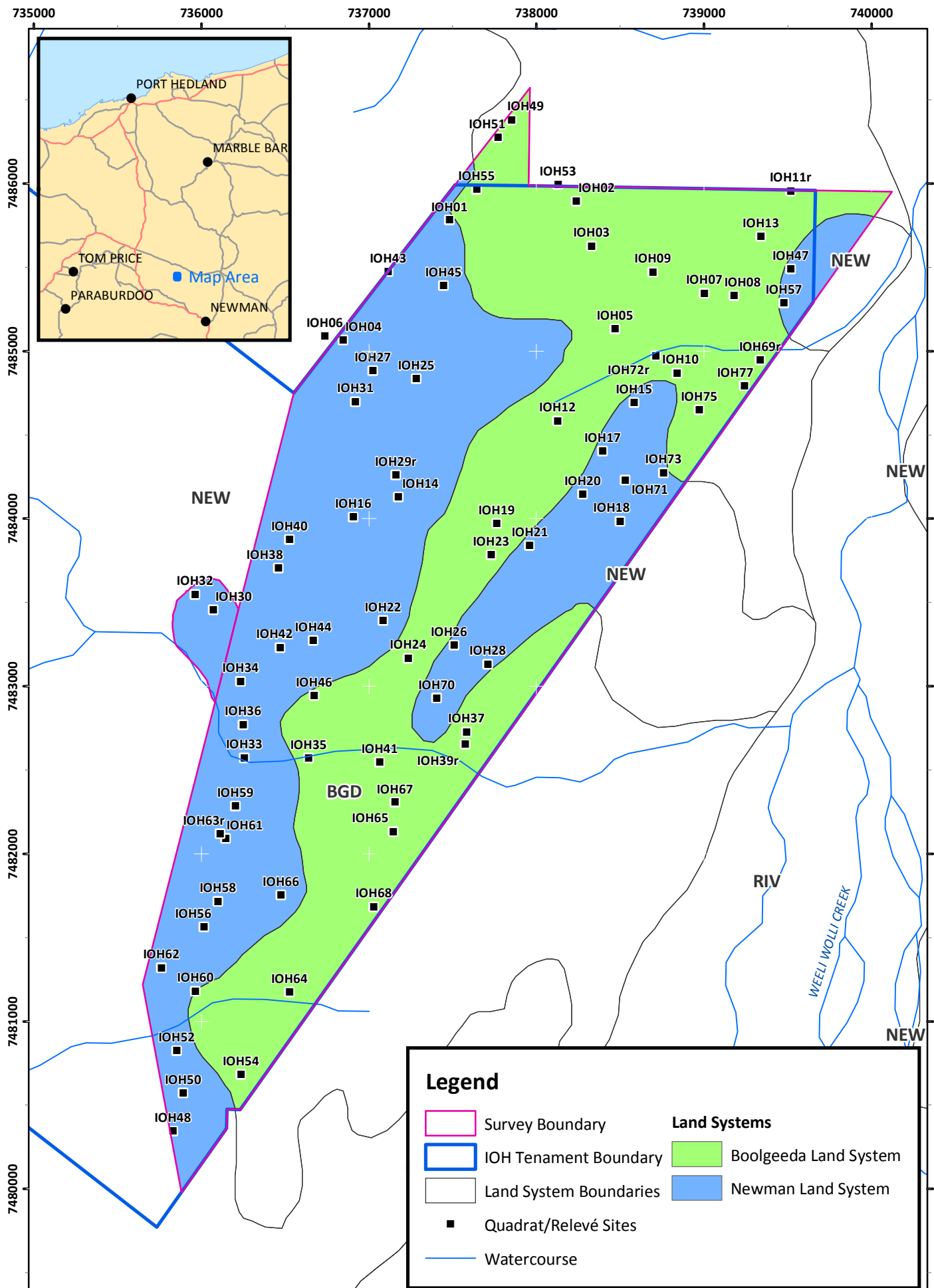
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Appendix A: Pre-European Vegetation and Land Systems Mapping

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IOH Iron Valley Flora and Vegetation Surveys

Figure A.1: Lands Systems in the IOH Iron Valley Survey Area.

Author: W. Thompson

Date: 16-12-2011

Drawn: R. Wathugala

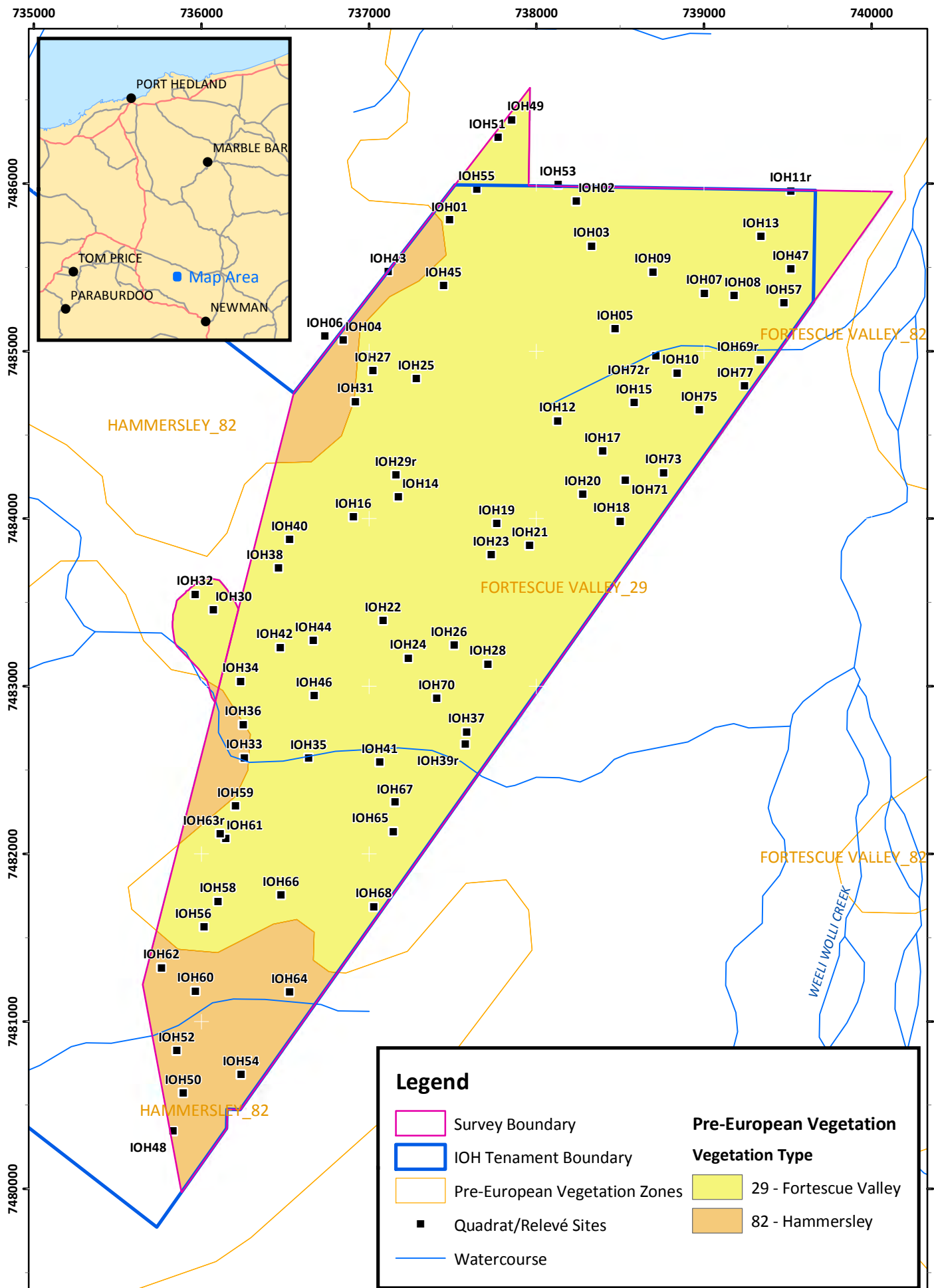
3923-11WMFV1RevB_20111216_Figure_A.1

Datum: GDA 1994
Projection: MGA Zone 50

0 250 500 1,000 1,500 Metres



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URS Australia Pty Ltd
IOH Iron Valley Flora and Vegetation Surveys

Figure A.2: Pre-European Vegetation in the IOH Iron Valley Survey Area.

Author: W. Thompson

Date: 16-12-2011

Drawn: R. Wathugala

3923-11WMFV1RevB_20111216_A.2

Datum: GDA 1994
Projection: MGA Zone 50

0 250 500 1,000 1,500 Metres



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Appendix B: Definitions, Categories and Criteria for Threatened and Priority Ecological Communities

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Table B.1: Categories of Threatened Ecological Communities (DEC 2007)

PD: Presumed Destroyed
An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future. An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies (A or B): A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or B) All occurrences recorded within the last 50 years have since been destroyed.
CR : Critically Endangered
An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated. An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C): A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii): i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years); ii) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated. B) Current distribution is limited, and one or more of the following apply (i, ii or iii): i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years); ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes; iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).

En: Endangered

An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.

An ecological community will be listed as **Endangered** when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting **any one or more** of the following criteria (A, B, or C):

A) The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement **and either or both** of the following apply (i or ii):

i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years);

ii) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

B) Current distribution is limited, **and one or more** of the following apply (i, ii or iii):

i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years);

ii) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes;

iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.

C) The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).

VU: Vulnerable

An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.

An ecological community will be listed as **Vulnerable** when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting **any one or more** of the following criteria (A, B or C):

A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.

B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.

C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

Table B.2: Definitions and Criteria for Priority Ecological Communities: Priority Ecological communities (DEC 2009).

Possible threatened ecological communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community Lists under Priorities 1, 2 and 3. Ecological Communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

P1: Priority One – Poorly-known ecological communities
Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
P2: Priority Two – Poorly-Known ecological communities
Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
P3: Priority Three – Poorly-Known ecological communities
(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; (iii) communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
P4: Priority Four
Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened or that have been recently removed from the threatened list. These communities require regular monitoring. (a) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands. (b) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (c) Ecological communities removed from the list of threatened communities during the past five years.

P5: Priority Five – Conservation dependent ecological communities

Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Table B.3: Definitions and Criteria for Threatened Ecological communities (DSEWPC 2010).

Three categories exist for listing threatened ecological communities under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). An ecological community may be categorised:

Categories of Ecological Communities	
Critically Endangered	If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future.
Vulnerable	If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

Appendix C: Categories of Conservation Significant Flora Species

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Table C.1: Categories of Conservation Significant Flora Species (Wildlife Conservation Act 1950).

T: Threatened Flora – (Declared Rare Flora - Extant)
Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such (Schedule 1 under the Wildlife Conservation Act 1950). Threatened Flora (Schedule 1) are further ranked by the Department according to their level of threat using IUCN Red List criteria: • CR: Critically Endangered – considered to be facing an extremely high risk of extinction in the wild • EN: Endangered – considered to be facing a very high risk of extinction in the wild • VU: Vulnerable – considered to be facing a high risk of extinction in the wild.
X: Presumed Extinct Flora (Declared Rare Flora – Extinct)
Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such (Schedule 2 under the Wildlife Conservation Act 1950). Species that have not yet been adequately surveyed to be listed under Schedule 1 or 2 are added to the Priority Flora List under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna. Species that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Conservation Dependent species are placed in Priority 5.
P1: Priority One - Poorly Known
Species that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.
P2: Priority Two - Poorly Known
Species that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.
P3: Priority Three - Poorly Known
Species that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.
P4: Priority Four - Rare, Near Threatened and other species in need of monitoring
a. Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. b. Near Threatened. Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. c. Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

P5: Priority Five: Conservation Dependent Species

Species that are not threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

Table C.2: Categories of Threatened Species (DSEWPC 2010).

Threatened flora may be listed in any one of the following categories as defined in Section 179 of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act):

Section 179 Categories of Threatened Species	
(1) A native species is eligible to be included in the extinct category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.	
(2) A native species is eligible to be included in the extinct in the wild* category at a particular time if, at that time:	
	(a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or
	(b) it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
(3) A native species is eligible to be included in the critically endangered* category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.	
(4) A native species is eligible to be included in the endangered category* at a particular time if, at that time:	
	(a) it is not critically endangered; and
	(b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
(5) A native species is eligible to be included in the vulnerable category* at a particular time if, at that time:	
	(a) it is not critically endangered or endangered; and
	(b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.
(6) A native species is eligible to be included in the conservation dependent category at a particular time if, at that time:	
	(a) the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or
	(b) the following subparagraphs are satisfied:
(i) the species is a species of fish;	
(ii) the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised;	
(iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory;	
(iv) cessation of the plan of management would adversely affect the conservation status of the species.	
(7) In subsection (6):	
fish includes all species of bony fish, sharks, rays, crustaceans, molluscs and other marine organisms, but does not include marine mammals or marine reptiles.	

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Appendix D: Categories of Introduced Flora Species

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Table D.1: Declared Plants Management Ratings as Gazetted under the Agriculture and Related Resources Protection Act 1976.

Listed species have a priority rating which defines their required level of management.	
Priority 1	Introduction of the plant into, or movement of the plant within, an area is prohibited;
Priority 2	Plant to be eradicated in the area.
Priority 3	Plant to be controlled by reduction in number or distribution of the plant or both.
Priority 4	Spread of plant beyond where it currently occurs to be prevented.
Priority 5	Particular action to be taken on public land or land under the control of a local government.

Table D.2: Invasive Plant Prioritisation Process Rating System (DEC 2011b).

Field	Description	Code	Code Description
Potential Distribution	Area of potential habitat in the Region that could be occupied of the area at risk of invasion by the weed.	L	Limited (localised)
		M	Moderate
		H	High
		E	Extensive (widespread)
		U	Unknown
Current Distribution	Area of habitat in the Region currently occupied by the weed.	L	Limited (localised)
		M	Moderate
		H	High
		E	Extensive (widespread)
		U	Unknown
Survey Effort	Survey effort of IBRA.	Nil	0%
		Some	0 - 25%
		Patchy	25 – 50%
		Extensive	50 – 75%
		Complete	75 – 100%
Abundance	Density class across one or more IBRA regions in the DEC region.	Occasional	Light – scattered individual plants (< 10 populations or 1 – 10% of IBRA region)
		Common	Medium to scattered patches with isolated plants interspersed (>10 populations or 11 – 50% of IBRA region)
		Abundant	Heavy to large infestations (>100 populations or 51 – 100% of IBRA region)
Ecological Impact	Impact of species with the Region, from low impact (causes minimal disruption to ecological processes or loss of	L	Low impact species
		M	Medium impact species
		H	High impact species

Field	Description	Code	Code Description
	biodiversity) to high (causes acute disruptions of ecological processes, dominates and/or significantly alters the vegetation structure, composition and function of ecosystems).	U	Unknown
Impact attributes	List of known ecological impact attribute, based on Platt et al (2005).	1	Changed fire regime
		2	Changed nutrient conditions
		3	Changed hydrological patterns
		4	Changed soil erosion patterns
		5	Changed geomorphological processes
		6	Changed biomass distribution
		7	Changed light distribution
		8	Loss of biodiversity
		9	Substantially reduces regeneration opportunities of native plants
		10	Allelopathic effects
Invasiveness	Rate of spread of a weed in native vegetation, encompassing factors of establishment, reproductions (time to seeding, seed production, vegetative reproductions) and dispersal (wind, water, flying animals, ground animals, deliberate human spread, vehicles, produce contaminant).	S	Slow
		M	Moderate
		R	Rapid
		U	Unknown
Feasibility of Control	The longer a coordinated control program takes to achieve its desired goal, the more expensive and less feasible it becomes. Key factors to consider include how widespread a weed is, ease of finding infestations, difficulty of limiting the weeds dispersal, willingness of landholders and governments to control the weed, and commercial use of the plant.	L	Low feasibility infestation
		M	Moderate feasibility infestation
		H	High feasibility infestation
		U	Unknown
General Trend	General trend in distribution and abundance across the region.	Decreasing	
		Increasing	
		Stable	
		Unknown	

Field	Description	Code	Code Description
Status	Define whether the species is outside the region, considered emerging (density class of occasional), established (density class of common or abundant) or unknown.	Outside	Occurs outside the region but known from WA
		Emerging	Density class of occasional
		Established	Density class of common or abundant
		Unknown	Current status in doubt or unknown

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Appendix E: Vegetation Classification and Condition Scales

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Table E.1: Vegetation Classification System Specht (1970) as modified by Aplin (1979).

Stratum	70-100% cover	30-70% cover	10-30% cover	2-10% cover	<2% cover
Trees > 30 m	Tall closed forest	Tall open Forest	Tall woodland	Tall open woodland	Scattered tall trees
Trees 10-30 m	Closed forest	Open forest	Woodland	Open woodland	Scattered trees
Trees < 10 m	Low closed forest	Low open forest	Low woodland	Low open woodland	Scattered low trees
Shrubs > 2 m	Tall closed scrub	Tall open scrub	Tall shrubland	Tall open shrubland	Scattered tall shrubs
Shrubs 1-2 m	Closed heath	Open heath	Shrubland	Open shrubland	Scattered shrubs
Shrubs < 1 m	Low closed heath	Low open heath	Low shrubland	Low open shrubland	Scattered low shrubs
Hummock grasses	Closed hummock grassland	Hummock grassland	Open hummock grassland	Very open hummock grassland	Scattered hummock grasses
Grasses, sedges, herbs	Closed tussock grassland/ sedgeland/ herbland	Tussock grassland/ sedgeland/ herbland	Open tussock grassland/ sedgeland/ herbland	Very open tussock grassland/ sedgeland/ herbland	Scattered tussock grasses / sedges / herbs

Table E.2: Summary of adapted Vegetation Condition Scale as developed by Keighery (1994).

Rating	Condition	Descriptive Features
1	Excellent	>80% native flora composition Vegetation structure (nearly) intact Minor signs of disturbance Weeds are non-aggressive species (cover <5%)
2	Good	60-80% native flora composition Vegetation structure altered in places Obvious signs of disturbance Weed abundance / cover 5-20%
3	Fair	40-60% native flora composition Vegetation structure significantly altered yet retains basic structure or ability to regenerate to it Very obvious signs of multiple disturbance Weed cover / abundance 50-80%
4	Poor/ Partially Degraded	20-40% native flora composition Vegetation structure severely impacted by disturbance Scope for regeneration but not to a level approaching “Good” condition without intensive management Weed cover / abundance 50-80%
5	Completely Degraded	<20% native flora composition Vegetation structure impacted beyond regeneration Extensive modification and disturbance present Weeds are highly invasive (cover / abundance >80%)

Appendix F: Data Analysis

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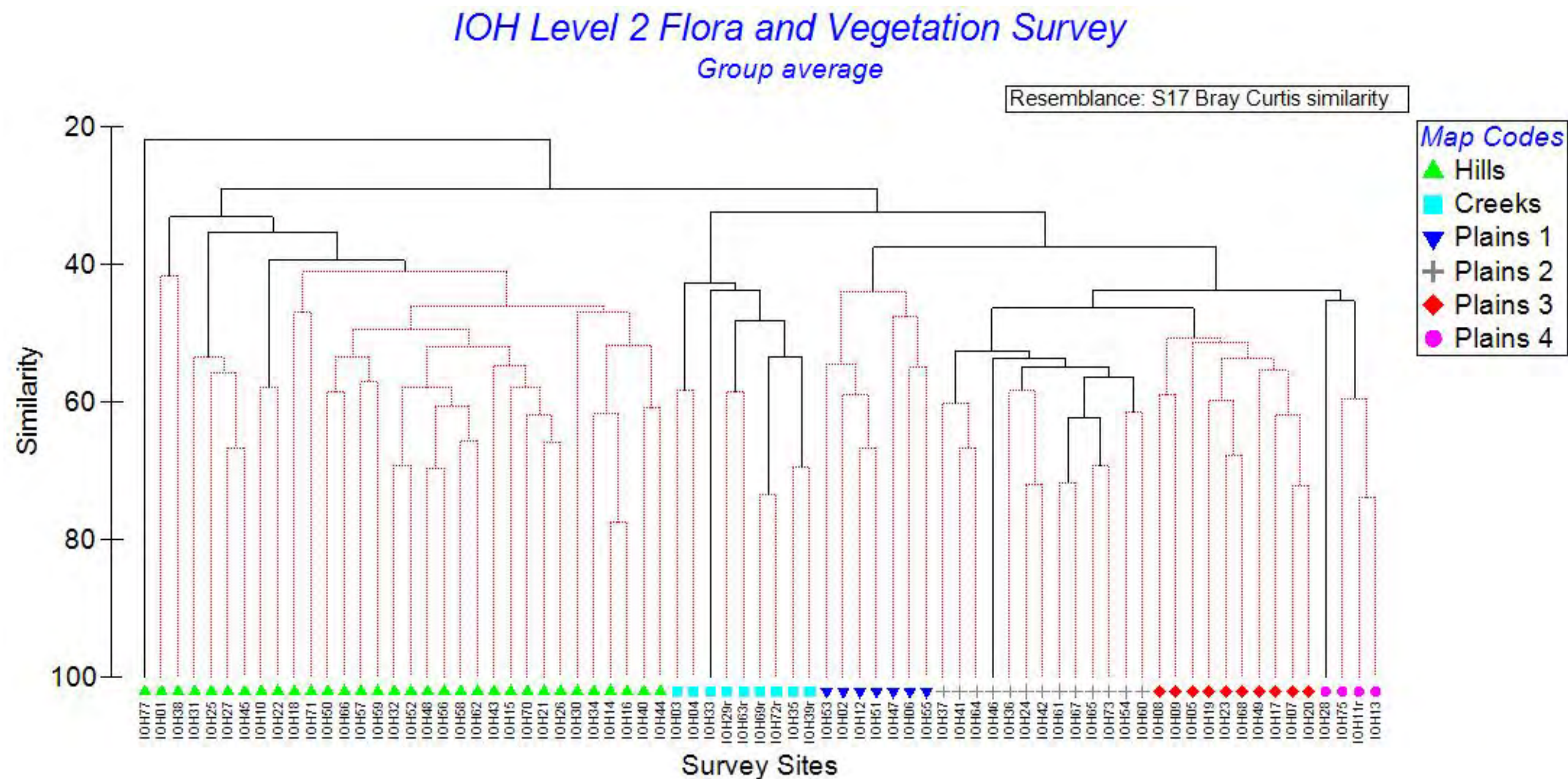


Figure F.1: Dendrogram of survey sites derived from the Primer CLUSTER analyses of the 143 perennial taxa from the 75 survey sites. The symbols above the survey site names correspond to the vegetation classification.

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Appendix G: Species List

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Table G.1. Flora species list, all species had the conservation status of 'not threatened' at the time of survey.

Family	Species	Weed (*)
Aizoaceae	<i>Trianthema glossostigma</i>	
Aizoaceae	<i>Trianthema pilosa</i>	
Amaranthaceae	<i>Amaranthus cuspidifolius</i>	
Amaranthaceae	<i>Amaranthus mitchellii</i>	
Amaranthaceae	<i>Amaranthus undulatus</i>	
Amaranthaceae	<i>Gomphrena affinis</i> subsp. <i>pilbarensis</i>	
Amaranthaceae	<i>Gomphrena cunninghamii</i>	
Amaranthaceae	<i>Gomphrena kanisii</i>	
Amaranthaceae	<i>Ptilotus aervoides</i>	
Amaranthaceae	<i>Ptilotus astrolasius</i>	
Amaranthaceae	<i>Ptilotus auriculifolius</i>	
Amaranthaceae	<i>Ptilotus calostachyus</i>	
Amaranthaceae	<i>Ptilotus clementii</i>	
Amaranthaceae	<i>Ptilotus exaltatus</i>	
Amaranthaceae	<i>Ptilotus fusiformis</i>	
Amaranthaceae	<i>Ptilotus gaudichaudii</i>	
Amaranthaceae	<i>Ptilotus helipteroides</i>	
Amaranthaceae	<i>Ptilotus obovatus</i>	
Amaranthaceae	<i>Ptilotus polystachyus</i>	
Amaranthaceae	<i>Ptilotus rotundifolius</i>	
Apocynaceae	<i>Marsdenia australis</i>	
Apocynaceae	<i>Rhyncharrhena linearis</i>	
Araliaceae	<i>Trachymene oleracea</i>	
Asteraceae	<i>Bidens bipinnata</i>	*
Asteraceae	<i>Peripleura arida</i>	
Asteraceae	<i>Pterocaulon sphaeranthoides</i>	
Asteraceae	<i>Sonchus oleraceus</i>	*
Asteraceae	<i>Streptoglossa bubakii</i>	
Boraginaceae	<i>Heliotropium chrysocarpum</i>	
Boraginaceae	<i>Heliotropium cunninghamii</i>	
Boraginaceae	<i>Trichodesma zeylanicum</i>	
Caryophyllaceae	<i>Polycarpaea corymbosa</i>	
Caryophyllaceae	<i>Polycarpaea holtzei</i>	
Caryophyllaceae	<i>Polycarpaea longiflora</i>	
Chenopodiaceae	<i>Dysphania kalpari</i>	
Chenopodiaceae	<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	
Chenopodiaceae	<i>Enchylaena tomentosa</i>	
Chenopodiaceae	<i>Rhagodia eremaea</i>	

Family	Species	Weed (*)
Chenopodiaceae	<i>Salsola tragus</i>	
Chenopodiaceae	<i>Sclerolaena cornishiana</i>	
Cleomaceae	<i>Cleome viscosa</i>	
Convolvulaceae	<i>Bonamia erecta</i>	
Convolvulaceae	<i>Bonamia media</i> var. <i>villosa</i>	
Convolvulaceae	<i>Bonamia rosea</i>	
Convolvulaceae	<i>Duperreya commixta</i>	
Convolvulaceae	<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	
Convolvulaceae	<i>Ipomoea polymorpha</i>	
Convolvulaceae	<i>Polymeria ambigua</i>	
Cucurbitaceae	<i>Cucumis maderaspatanus</i>	
Cyperaceae	<i>Bulbostylis barbata</i>	
Cyperaceae	<i>Fimbristylis microcarya</i>	
Cyperaceae	<i>Fimbristylis simulans</i>	
Euphorbiaceae	<i>Euphorbia australis</i>	
Euphorbiaceae	<i>Euphorbia biconvexa</i>	
Euphorbiaceae	<i>Euphorbia boophthona</i>	
Euphorbiaceae	<i>Euphorbia tannensis</i>	
Euphorbiaceae	<i>Euphorbia tannensis</i> subsp. <i>eremophila</i>	
Fabaceae	<i>Acacia adoxa</i> var. <i>adoxo</i>	
Fabaceae	<i>Acacia adsurgens</i>	
Fabaceae	<i>Acacia ancistrocarpa</i>	
Fabaceae	<i>Acacia aptaneura</i>	
Fabaceae	<i>Acacia arida</i>	
Fabaceae	<i>Acacia bivenosa</i>	
Fabaceae	<i>Acacia citrinoviridis</i>	
Fabaceae	<i>Acacia dictyophleba</i>	
Fabaceae	<i>Acacia hamersleyensis</i>	
Fabaceae	<i>Acacia hilliana</i>	
Fabaceae	<i>Acacia holosericea</i>	
Fabaceae	<i>Acacia inaequilatera</i>	
Fabaceae	<i>Acacia maitlandii</i>	
Fabaceae	<i>Acacia melleodora</i>	
Fabaceae	<i>Acacia monticola</i>	
Fabaceae	<i>Acacia pachyacra</i>	
Fabaceae	<i>Acacia pruinocarpa</i>	
Fabaceae	<i>Acacia pyrifolia</i>	
Fabaceae	<i>Acacia spondylophylla</i>	
Fabaceae	<i>Acacia synchronicia</i>	
Fabaceae	<i>Acacia tenuissima</i>	

Family	Species	Weed (*)
Fabaceae	<i>Acacia tumida</i>	
Fabaceae	<i>Acacia tumida</i> var. <i>pilbarensis</i>	
Fabaceae	<i>Crotalaria medicaginea</i> var. <i>neglecta</i>	
Fabaceae	<i>Crotalaria novae-hollandiae</i> subsp. <i>novae-hollandiae</i>	
Fabaceae	<i>Cullen lachnostachys</i>	
Fabaceae	<i>Gompholobium polyzygum</i>	
Fabaceae	<i>Indigofera georgei</i>	
Fabaceae	<i>Indigofera monophylla</i>	
Fabaceae	<i>Isotropis atropurpurea</i>	
Fabaceae	<i>Mirbelia viminalis</i>	
Fabaceae	<i>Petalostylis cassioides</i>	
Fabaceae	<i>Petalostylis labicheoides</i>	
Fabaceae	<i>Rhynchosia minima</i>	
Fabaceae	<i>Senna artemisioides</i> subsp. <i>helmsii</i>	
Fabaceae	<i>Senna artemisioides</i> subsp. <i>helmsii</i> x <i>oligophylla</i>	
Fabaceae	<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	
Fabaceae	<i>Senna curvistyla</i>	
Fabaceae	<i>Senna ferraria</i>	
Fabaceae	<i>Senna glaucifolia</i>	
Fabaceae	<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	
Fabaceae	<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	
Fabaceae	<i>Senna glutinosa</i> subsp. x <i>luerssenii</i>	
Fabaceae	<i>Senna notabilis</i>	
Fabaceae	<i>Tephrosia</i> aff. <i>supina</i>	
Fabaceae	<i>Tephrosia densa</i>	
Fabaceae	<i>Tephrosia rosea</i>	
Fabaceae	<i>Tephrosia rosea</i> var. <i>glabrior</i>	
Fabaceae	<i>Tephrosia</i> sp. Bungaroo Creek (M.E. Trudgen 11601)	
Fabaceae	<i>Tephrosia</i> sp. Cathedral Gorge (F.H. Mollemans 2420)	
Fabaceae	<i>Tephrosia supina</i>	
Goodeniaceae	<i>Dampiera candidans</i>	
Goodeniaceae	<i>Goodenia microptera</i>	
Goodeniaceae	<i>Goodenia muelleriana</i>	
Goodeniaceae	<i>Goodenia prostrata</i>	
Goodeniaceae	<i>Goodenia stobbsiana</i>	
Goodeniaceae	<i>Goodenia triodiophila</i>	
Goodeniaceae	<i>Scaevola parvifolia</i> subsp. <i>pilbarae</i>	
Goodeniaceae	<i>Scaevola spinescens</i>	
Goodeniaceae	<i>Velleia connata</i>	
Haloragaceae	<i>Haloragis gossei</i>	

Family	Species	Weed (*)
Haloragaceae	<i>Haloragis gossei</i> var. <i>gossei</i>	
Lamiaceae	<i>Clerodendrum floribundum</i>	
Lamiaceae	<i>Clerodendrum floribundum</i> var. <i>angustifolium</i>	
Lamiaceae	<i>Clerodendrum floribundum</i> var. <i>floribundum</i>	
Lamiaceae	<i>Dicrastylis cordifolia</i>	
Lauraceae	<i>Cassytha capillaris</i>	
Loranthaceae	<i>Amyema gibberula</i> var. <i>gibberula</i>	
Loranthaceae	<i>Amyema miquelii</i>	
Malvaceae	<i>Abutilon dioicum</i>	
Malvaceae	<i>Abutilon lepidum</i>	
Malvaceae	<i>Abutilon leucopetalum</i>	
Malvaceae	<i>Abutilon otocarpum</i>	
Malvaceae	<i>Abutilon trudgenii</i>	
Malvaceae	<i>Corchorus crozophorifolius</i>	
Malvaceae	<i>Corchorus lasiocarpus</i> subsp. <i>lasiocarpus</i>	
Malvaceae	<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	
Malvaceae	<i>Corchorus tectus</i>	
Malvaceae	<i>Corchorus tridens</i>	
Malvaceae	<i>Gossypium australe</i>	
Malvaceae	<i>Gossypium robinsonii</i>	
Malvaceae	<i>Hibiscus</i> aff. <i>coatesii</i>	
Malvaceae	<i>Hibiscus coatesii</i>	
Malvaceae	<i>Hibiscus leptocladus</i>	
Malvaceae	<i>Hibiscus sturtii</i> var. <i>campylochlamys</i>	
Malvaceae	<i>Hibiscus sturtii</i> var. <i>platychlamys</i>	
Malvaceae	<i>Keraudrenia nephrosperma</i>	
Malvaceae	<i>Keraudrenia velutina</i> subsp. <i>elliptica</i>	
Malvaceae	<i>Rulingia luteiflora</i>	
Malvaceae	<i>Sida</i> aff. <i>fibulifera</i> (oblong; MET 15 220)	
Malvaceae	<i>Sida arenicola</i>	
Malvaceae	<i>Sida cardiophylla</i>	
Malvaceae	<i>Sida fibulifera</i>	
Malvaceae	<i>Sida</i> sp. Articulation below (A.A. Mitchell PRP 1605)	
Malvaceae	<i>Sida</i> sp. Excedentifolia (J.L. Egan 1925)	
Malvaceae	<i>Sida</i> sp. Pilbara (A.A. Mitchell PRP 1543)	
Malvaceae	<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)	
Malvaceae	<i>Sida</i> sp. verrucose glands (F.H. Mollemans 2423)	
Malvaceae	<i>Triumfetta maconochieana</i>	
Malvaceae	<i>Waltheria indica</i>	
Molluginaceae	<i>Mollugo molluginea</i>	

Family	Species	Weed (*)
Moraceae	<i>Ficus brachypoda</i>	
Myrtaceae	<i>Calytrix carinata</i>	
Myrtaceae	<i>Corymbia deserticola</i>	
Myrtaceae	<i>Corymbia hamersleyana</i>	
Myrtaceae	<i>Corymbia opaca</i>	
Myrtaceae	<i>Eucalyptus gamophylla</i>	
Myrtaceae	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	
Myrtaceae	<i>Eucalyptus victrix</i>	
Nyctaginaceae	<i>Boerhavia coccinea</i>	
Oleaceae	<i>Jasminum didymum</i> subsp. <i>lineare</i>	
Phyllanthaceae	<i>Notoleptopus decaisnei</i>	
Phyllanthaceae	<i>Phyllanthus maderaspatensis</i>	
Plantaginaceae	<i>Stemodia grossa</i>	
Poaceae	<i>Amphipogon sericeus</i>	
Poaceae	<i>Aristida contorta</i>	
Poaceae	<i>Aristida holathera</i> var. <i>holathera</i>	
Poaceae	<i>Aristida hygrometrica</i>	
Poaceae	<i>Aristida inaequiglumis</i>	
Poaceae	<i>Cenchrus ciliaris</i>	*
Poaceae	<i>Cenchrus setiger</i>	*
Poaceae	<i>Chrysopogon fallax</i>	
Poaceae	<i>Cymbopogon ambiguus</i>	
Poaceae	<i>Cymbopogon obtectus</i>	
Poaceae	<i>Digitaria ctenantha</i>	
Poaceae	<i>Enneapogon lindleyanus</i>	
Poaceae	<i>Enneapogon polyphyllus</i>	
Poaceae	<i>Enneapogon robustissimus</i>	
Poaceae	<i>Eragrostis cumingii</i>	
Poaceae	<i>Eragrostis eriopoda</i>	
Poaceae	<i>Eragrostis tenellula</i>	
Poaceae	<i>Eriachne aristidea</i>	
Poaceae	<i>Eriachne lanata</i>	
Poaceae	<i>Eriachne mucronata</i>	
Poaceae	<i>Eriachne pulchella</i>	
Poaceae	<i>Eriachne tenuiculmis</i>	
Poaceae	<i>Eulalia aurea</i>	
Poaceae	<i>Paraneurachne muelleri</i>	
Poaceae	<i>Paspalidium basicladum</i>	
Poaceae	<i>Paspalidium clementii</i>	
Poaceae	<i>Perotis rara</i>	

Family	Species	Weed (*)
Poaceae	<i>Schizachyrium fragile</i>	
Poaceae	<i>Setaria dielsii</i>	
Poaceae	<i>Sporobolus australasicus</i>	
Poaceae	<i>Themeda triandra</i>	
Poaceae	<i>Tragus australianus</i>	
Poaceae	<i>Triodia ? brizoides</i>	
Poaceae	<i>Triodia ? wiseana</i>	
Poaceae	<i>Triodia basedowii</i>	
Poaceae	<i>Triodia brizoides</i>	
Poaceae	<i>Triodia epactia</i>	
Poaceae	<i>Triodia lanigera</i>	
Poaceae	<i>Triodia schinzii</i>	
Poaceae	<i>Triodia</i> sp. (epactia/pungens)	
Poaceae	<i>Triodia</i> sp. Shovelanna Hill (S. van Leeuwen 3835)	
Poaceae	<i>Triodia wiseana</i>	
Poaceae	<i>Yakirra australiensis</i> var. <i>australiensis</i>	
Polygalaceae	<i>Polygala isingii</i>	
Portulacaceae	<i>Portulaca oleracea</i>	*
Proteaceae	<i>Grevillea wickhamii</i>	
Proteaceae	<i>Grevillea wickhamii</i> subsp. <i>hispidula</i>	
Proteaceae	<i>Hakea chordophylla</i>	
Proteaceae	<i>Hakea lorea</i>	
Pteridaceae	<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	
Rubiaceae	<i>Oldenlandia crouchiana</i>	
Santalaceae	<i>Anthobolus leptomerioides</i>	
Santalaceae	<i>Santalum lanceolatum</i>	
Sapindaceae	<i>Atalaya hemiglauca</i>	
Sapindaceae	<i>Dodonaea coriacea</i>	
Scrophulariaceae	<i>Eremophila longifolia</i>	
Solanaceae	<i>Solanum ellipticum</i>	
Solanaceae	<i>Solanum horridum</i>	
Solanaceae	<i>Solanum lasiophyllum</i>	
Solanaceae	<i>Solanum phlomoides</i>	
Solanaceae	<i>Solanum sturtianum</i>	
Surianaceae	<i>Stylobasium spathulatum</i>	
Violaceae	<i>Hybanthus aurantiacus</i>	
Zygophyllaceae	<i>Tribulopsis angustifolia</i>	
Zygophyllaceae	<i>Tribulus hirsutus</i>	
Zygophyllaceae	<i>Tribulus macrocarpus</i>	
Zygophyllaceae	<i>Tribulus suberosus</i>	

Appendix H: Descriptions of Species with Range Extensions

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Table H.1: Locations of Range Extension Species Recorded in the Survey Area.

Species	Site	Vegetation Association	GPS coordinate (GDA 94)
<i>Senna curvistyla</i> (J.M. Black) Randell	IOH23	<i>Petalostylis labicheoides</i> scattered shrubs over <i>Sida</i> sp. Pilbara scattered shrubs over <i>Bonamia rosea</i> low open shrubland over <i>Triodia lanigera</i> very open hummock grassland.	737732 E, 7483784 N
<i>Aristida hygrometrica</i> R. Br.	IOH09	<i>Acacia inaequilatera</i> scattered tall shrubs and <i>Eucalyptus gamophylla</i> low open woodland over <i>Petalostylis labicheoides</i> scattered shrubs over <i>Triodia basedowii</i> open hummock grassland.	738696 E, 7485474 N

Table H.2: Description of Range Extension Species Recorded in the Survey Area (WAHERB 2011).

Species	Description	Habitat
<i>Senna curvistyla</i> (J.M. Black) Randell  <i>Senna curvistyla</i> Photos: C.P. Campbell	A small shrub 0.1 to 0.3 m tall. It produces yellow flowers from May to August.	<i>S. curvistyla</i> has been recorded in deep red desert sand, sand dunes and gravelly plains.
<i>Aristida hygrometrica</i> R.Br.  <i>Aristida hygrometrica</i> Photos: L. Wallis	A loosely tufted annual, grass-like herb 0.29 to 0.84 m high. It produces brown flowers from March to May.	<i>A. hygrometrica</i> has been recorded in red sand, red clay and alluvium, and often dominates extensive grass levees. It is often found in <i>Eucalyptus</i> and <i>Melaleuca</i> woodland.

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Appendix I: Introduced Flora Descriptions

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Table I.1: Summary assessment of introduced flora recorded in the Survey Area (DEC 2011)

Species	Ecological Impact (Low, Moderate, High, Unknown)	Current Distribution (Low, Moderate, High, Unknown)	Potential Distribution (Low, Moderate, High, Unknown)	Invasiveness (Rapid, Moderate, Slow)	General Trend (Increasing, Stable, Decreasing, Unknown)	Status (Outside, Emerging, Established, Unknown)	Feasibility for Control (Low, Moderate, High, Unknown)
<i>*Bidens bipinnata</i>	Unknown	High	High	Rapid	n/a	n/a	Low
<i>*Cenchrus ciliaris</i>	High	High	High	Rapid	Increasing	Established	Low
<i>*Cenchrus setiger</i>	High	High	High	Rapid	Increasing	Established	Low
<i>*Portulaca oleracea</i>	n/a	n/a	n/a	n/a	n/a	n/a	n/a
<i>*Sonchus oleraceus</i>	Low	High	Low	Rapid	n/a	n/a	Low

Table I.2: Description of Introduced Flora recorded in the Survey Area

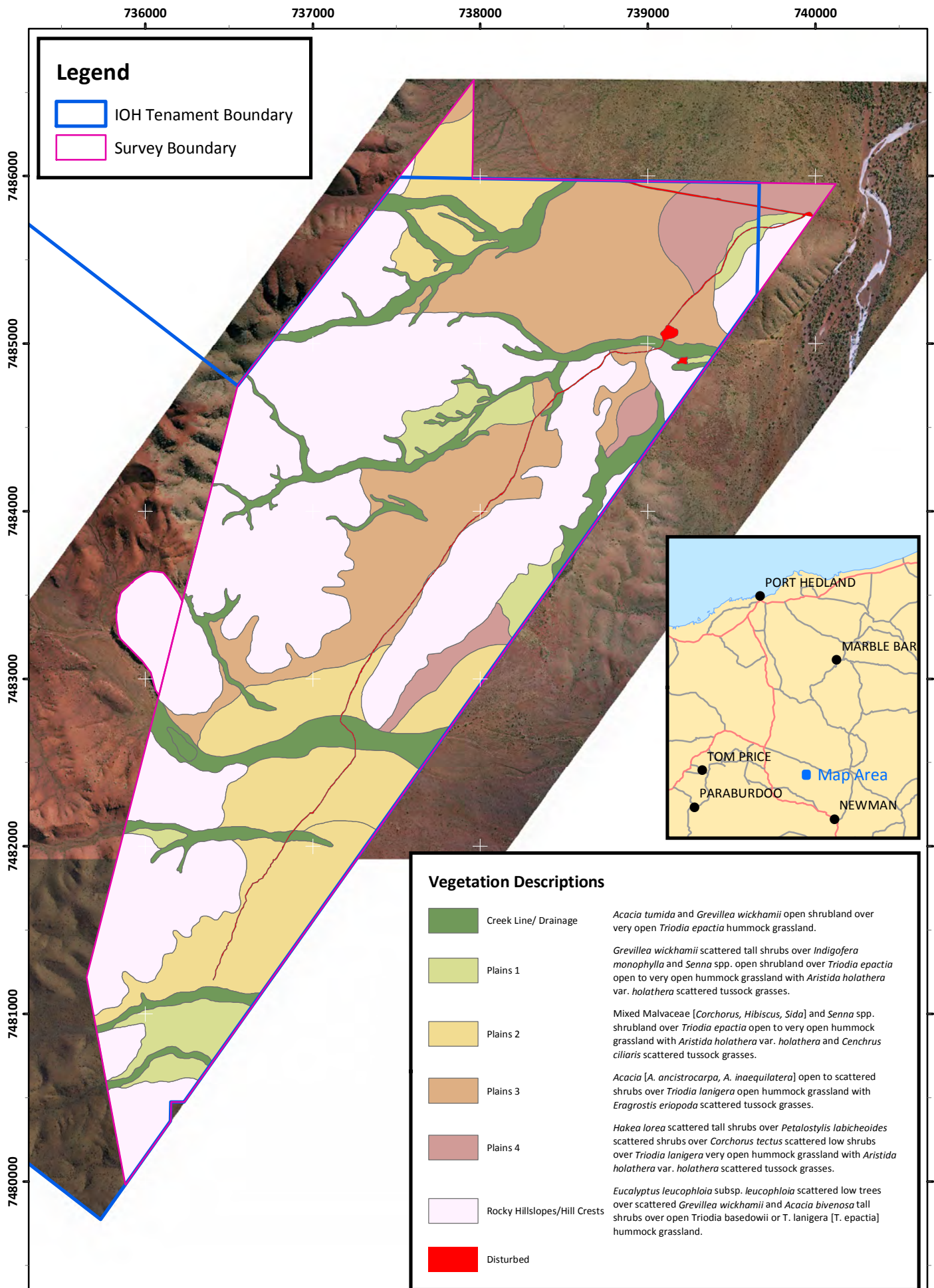
Name	Description	Habitat
<i>*Bidens bipinnata</i> (Bipinnate beggartick)  <i>Bidens bipinnata</i> Photos: G. Byrne	An erect annual herb, between 0.1 and 0.9 m (sometimes to 1.5 m) high with yellow flowers that bloom from March to September.	<i>Bidens bipinnata</i> favors alluvium, clay, loam over sandstone and limestone. It is usually found along rivers & creeks, coastal areas and on rocky hillsides.
<i>Cenchrus ciliaris</i> (Buffel Grass) 	A tufted or sometimes stoloniferous perennial grass between 0.2 and 1.5 m in height with purple, ciliate flowers between February and October. <i>C. ciliaris</i> was originally planted as a pastoral grass in the region, but it has been shown to suppress the growth of surrounding plants due to allelopathic compounds (Halsall <i>et al.</i> 1995) and therefore has the ability to alter the composition vegetation communities.	<i>C. ciliaris</i> favours sand but may also establish in loamy and clayey soils, particularly disturbed soils in coastal and drainage areas.
<i>*Cenchrus setiger</i> (Birdwood Grass)  <i>Cenchrus setiger</i> Photos: G. Byrne	A tussocky or sometimes stoloniferous perennial grass to 0.5 m in height with dark, hardening flowers. Flowering between April and May.	Favours sands, red loam, dunes, plains, rangelands, stony hills, and floodplains.

Name	Description	Habitat
<i>Portulaca oleracea</i> (Purslane) 	A succulent, prostrate to decumbent annual herb to 0.2 m in height. Flowers are yellow from April to May.	<i>P. oleracea</i> favors clayey, loam areas but appears widespread in most low lying habitats.
*<i>Sonchus oleraceus</i> (Common sowthistle)  <i>Sonchus oleraceus</i> Photos: S.M. Armstrong & L. Fontanini	An erect annual or possibly biennial herb to 1.5 m high. Its yellow flowers bloom all year round. Known to hybridize with <i>S. asper</i>.	<i>S. oleraceus</i> is a weed of waste places and disturbed ground. Seed is dispersed by the wind. Seed is able to germinate all year round and is favoured by light, with emergence highest when seed is present on the soil surface.

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Appendix J: Vegetation Mapping

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IOH Iron Valley Flora and Vegetation Surveys

Figure J.1: Vegetation Mapping in IOH Iron Valley Survey Area.

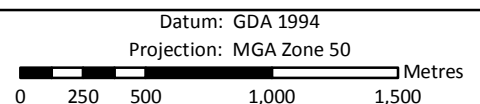


Author: W. Thompson

Date: 16-12-2011

Drawn: R. Wathugala

3923-11WMFV1RevB_20111216_Figure_J.1



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Appendix K: Quadrat and Relevé Data

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URS/IOH Iron Valley

Site

IOH01

Location: Iron Valley
m

Type: Q

50 x 50

1st Observation: Date: 9/04/2011 Described by: WNNC Seasonal Conditions: E

2nd Observation: Date: 2/08/2011 Described by: WTTDO Seasonal Conditions: E

MGA Zone: 50 Easting: 737482 mE Northing: 7485780 mN

Habitat: Lower slope of hill on BIF seam (exposed bedrock <1%).

Soil: Red brown skeletal sandy loam

Rock Type: BIF

Vegetation: *Acacia bivenosa* low open woodland over *Grevillea wickhamii* scattered shrubs over *Triodia lanigera* and *T. epactia* hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: excellent

Fire Age: 5-10 years

Notes:

Species List

Name	% Cover	Height
	+	4.00
<i>Acacia bivenosa</i>	+	4.00
<i>Boerhavia coccinea</i>	+	0.10
<i>Cleome viscosa</i>	+	0.06
<i>Dysphania kalpari</i>	+	0.05
<i>Eriachne aristidea</i>	+	0.30
<i>Eriachne lanata</i>	+	0.30
<i>Eriachne pulchella</i>	+	0.10
<i>Fimbristylis simulans</i>	+	0.25
<i>Gomphrena cunninghamii</i>	+	0.08
<i>Gomphrena kanisii</i>	+	0.20
<i>Goodenia stobbsiana</i>	+	0.08
<i>Grevillea wickhamii</i> subsp. <i>hispidula</i>	+	1.80
<i>Paspalidium clementii</i>	+	0.12
<i>Polygala isingii</i>	+	0.06
<i>Ptilotus auriculifolius</i>	+	0.25
<i>Ptilotus calostachyus</i>	+	0.70
<i>Ptilotus exaltatus</i>	+	0.60
<i>Ptilotus rotundifolius</i>	+	0.30
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.70
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	1.20
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	+	1.20
<i>Trianthema glossostigma</i>	+	0.04
<i>Trichodesma zeylanicum</i>	+	0.40
<i>Triodia basedowii</i>	55	0.35
<i>Triodia epactia</i>	+	0.9
<i>Triodia wiseana</i>	+	0.25

URS/IOH Iron Valley

Site

IOH02

Location: Iron Valley
m

Type: Q

50 x 50

1st Observation: Date: 9/04/2011

Described by: WNNC

Seasonal Conditions: E

2nd Observation: Date: 2/08/2011

Described by: WTTDO

Seasonal Conditions: E

MGA Zone: 50

Easting: 738239 mE

Northing: 7485893 mN

Habitat: Flat - pediment

Soil: Red brown, shallow

Rock Type: BIF, coarse fragments

Vegetation: *Grevillea wickhamii* scattered tall shrubs over *Acacia adoxa* var. *adoxo* scattered low shrubs over *Triodia basedowii*, *T. epactia* open hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: good

Fire Age: no fire evident

Notes: Quadrat adjacent to drill pads

Species List

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	1	0.80
<i>Acacia bivenosa</i>	+	3.00
<i>Acacia inaequilatera</i>	+	1.60
<i>Aristida contorta</i>	+	0.30
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.30
<i>Bonamia rosea</i>	+	0.30
<i>Cleome viscosa</i>	+	0.40
<i>Corymbia hamersleyana</i>	+	1.00
<i>Dicrastylis cordifolia</i>	+	0.40
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.07
<i>Eriachne mucronata</i>	+	0.30
<i>Eriachne pulchella</i>	+	0.12
<i>Fimbristylis simulans</i>	+	0.20
<i>Goodenia microptera</i>	+	0.15
<i>Grevillea wickhamii</i>	1	2.20
<i>Hakea chordophylla</i>	+	0.60
<i>Haloragis gossei</i>	+	0.12
<i>Heliotropium chrysocarpum</i>	+	0.06
<i>Heliotropium cunninghamii</i>	+	0.12
<i>Indigofera monophylla</i>	+	0.20
<i>Mollugo molluginea</i>	+	0.04
<i>Polycarpaea corymbosa</i>	+	0.12
<i>Polycarpaea holtzei</i>	+	0.20
<i>Ptilotus calostachyus</i>	+	0.5
<i>Ptilotus exaltatus</i>	+	0.10
<i>Scaevola parvifolia</i> subsp. <i>pilbarae</i>	+	0.20
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.80
<i>Senna glutinosa</i> subsp. x <i>luerssenii</i>	+	0.90
<i>Trianthema glossostigma</i>	+	0.05
<i>Tribulus hirsutus</i>	+	0.15
<i>Trichodesma zeylanicum</i>	+	0.25
<i>Triodia basedowii</i>	15	0.40
<i>Triodia epactia</i>	8	0.65

URS/IOH Iron Valley

Site

IOH03

Location: Iron Valley
m

Type: Q

50 x 50

1st Observation: Date: 9/04/2011 Described by: WNNC Seasonal Conditions: E

2nd Observation: Date: 3/08/2011 Described by: WTTDO Seasonal Conditions: E

MGA Zone: 50 Easting: 738331 mE Northing: 7485626 mN

Habitat: Flat overflow drainage area

Soil: Red/brown sandy loam

Rock Type: Ironstone

Vegetation: *Grevillea wickhamii* scattered tall shrubs over *Senna artemisioides* subsp. *oligophylla*
scattered low shrubs over *Triodia lanigera*, *T. epactia* hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 5 - 10 yrs

Notes:

Species List

Name	% Cover	Height
	+	1.00
<i>Abutilon dioicum</i>	+	1.00
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.80
<i>Acacia ancistrocarpa</i>	+	2.00
<i>Acacia arida</i>	+	1.70
<i>Acacia pyrifolia</i>	+	3.50
<i>Acacia spondylophylla</i>	+	1.00
<i>Acacia tumida</i> var. <i>pilbarensis</i>	+	2.2
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.35
<i>Boerhavia coccinea</i>	+	
<i>Bulbostylis barbata</i>	+	0.08
<i>Cleome viscosa</i>	+	0.50
<i>Corchorus tectus</i>	+	0.40
<i>Corymbia hamersleyana</i>	+	4.00
<i>Crotalaria medicaginea</i> var. <i>neglecta</i>	+	0.25
<i>Cucumis maderaspatanus</i>	+	climber
<i>Digitaria ctenantha</i>	+	0.40
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.05
<i>Eragrostis eriopoda</i>	+	0.20
<i>Eriachne aristidea</i>	+	0.15
<i>Eriachne pulchella</i>	+	0.08
<i>Euphorbia australis</i>	+	0.10
<i>Euphorbia biconvexa</i>	+	0.40
<i>Fimbristylis simulans</i>	+	0.10
<i>Gomphrena cunninghamii</i>	+	0.08
<i>Goodenia microptera</i>	+	0.45
<i>Gossypium australe</i>	+	0.60
<i>Gossypium robinsonii</i>	+	1.50
<i>Grevillea wickhamii</i>	1	2.50
<i>Hakea chordophylla</i>	+	1.80
<i>Hakea lorea</i>	+	2.20
<i>Hybanthus aurantiacus</i>	+	0.20
<i>Indigofera monophylla</i>	+	0.45
<i>Mollugo molluginea</i>	+	
<i>Polycarpaea longiflora</i>	+	0.45
<i>Polymeria ambigua</i>	+	

<i>Ptilotus astrolasius</i>	+	1.00
<i>Ptilotus calostachyus</i>	+	0.70
<i>Rhynchosia minima</i>	+	0.10
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	+	0.35
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	1	0.70
<i>Themeda triandra</i>	+	0.30
<i>Trianthema pilosa</i>	+	prostrate
<i>Trichodesma zeylanicum</i>	+	0.30
<i>Triodia epactia</i>	40	0.70
<i>Triodia lanigera</i>	10	0.40
<i>Yakirra australiensis</i> var. <i>australiensis</i>	+	0.05

URS/IOH Iron Valley

Site

IOH04

Location: Iron Valley
m

Type: Q

50 x 50

1st Observation: Date: 10/04/2011 Described by: WT/NK

Seasonal Conditions: E

2nd Observation: Date: 3/08/2011 Described by: WTTDO

Seasonal Conditions: E

MGA Zone: 50 Easting: 736847 mE

Northing: 7485064 mN

Habitat: Drainage valley, base of ridge

Soil: Red brown sandy loam

Rock Type: BIF

Vegetation: *Corymbia hamersleyana* scattered low trees over *Acacia inaequilatera*, *Grevillea wickhamii* tall open shrubland over *Gossypium australe* scattered shrubs over *A. arida*, *Stylobasium spathulatum* low open shrubland over *Triodia epactia* hummock grassland and *Eriachne tenuiculmis* scattered tussock grasses.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 2 - 5 yrs

Notes:

Species List

Name	% Cover	Height
<i>Abutilon dioicum</i>	+	1.00
<i>Acacia arida</i>	+	0.70
<i>Acacia dictyophleba</i>	+	1.50
<i>Acacia inaequilatera</i>	1	4.00
<i>Acacia pachyacra</i>	+	2.50
<i>Acacia pruinocarpa</i>	+	1.20
<i>Acacia pyrifolia</i>	+	1.60
<i>Acacia spondylophylla</i>	+	1.10
<i>Acacia tumida</i> var. <i>pilbarensis</i>	+	2.50
<i>Amaranthus cuspidifolius</i>	+	0.08
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.40
<i>Atalaya hemiglauca</i>	+	0.20
<i>Boerhavia coccinea</i>	+	0.10
<i>Bulbostylis barbata</i>	+	0.10
<i>Cleome viscosa</i>	+	0.50
<i>Clerodendrum floribundum</i>	+	1.00
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	0.40
<i>Corchorus tridens</i>	+	0.35
<i>Corymbia hamersleyana</i>	1	5.50
<i>Cymbopogon obtectus</i>	+	0.60
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.06
<i>Enneapogon robustissimus</i>	+	0.45

<i>Eragrostis tenellula</i>	+	0.30
<i>Eriachne pulchella</i>	+	0.12
<i>Eriachne tenuiculmis</i>	1	0.50
<i>Euphorbia australis</i>	+	0.05
<i>Euphorbia biconvexa</i>	+	0.30
<i>Euphorbia boophthona</i>	+	0.25
<i>Gomphrena cunninghamii</i>	+	0.20
<i>Gossypium australe</i>	+	1.80
<i>Gossypium robinsonii</i>	+	2.20
<i>Grevillea wickhamii</i>	1	3.00
<i>Hakea lorea</i>	+	2.20
<i>Indigofera monophylla</i>	+	0.40
<i>Notoleptopus decaisnei</i>	+	0.30
<i>Paspalidium clementii</i>	+	0.15
<i>Perotis rara</i>	+	0.18
<i>Petalostylis labicheoides</i>	+	2.20
<i>Polycarpaea longiflora</i>	+	0.30
<i>Polymeria ambigua</i>	+	0.05
<i>Portulaca oleracea</i>	+	0.05
<i>Pterocaulon sphaeranthoides</i>	+	0.04
<i>Ptilotus auriculifolius</i>	+	0.40
<i>Rhynchosia minima</i>	+	0.55
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	+	1.30
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	1.0
<i>Sporobolus australasicus</i>	+	0.08
<i>Stylobasium spathulatum</i>	1	0.60
<i>Themeda triandra</i>	+	0.30
<i>Trichodesma zeylanicum</i>	+	0.60
<i>Triodia epactia</i>	45	1.00

URS/IOH Iron Valley

Site

IOH05

Location: Iron Valley
m

Type: Q

50 x 50

1st Observation: Date: 10/04/2011 Described by: NC/CW

Seasonal Conditions: E

2nd Observation: Date: Described by: WTTDO

Seasonal Conditions: E

MGA Zone: 50 Easting: 738470 mE

Northing: 7485133 mN

Habitat: Open flat plain to east of tall hills

Soil: Red brown fine sandy loam

Rock Type: Ironstone

Vegetation: *Hakea chordophylla* scattered low trees over *Acacia inaequilatera* tall open shrubland over *Triodia lanigera* hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: excellent

Fire Age: No fire evident

Notes:

Species List

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.50
<i>Acacia bivenosa</i>	+	2.50
<i>Acacia inaequilatera</i>	2	2.50
<i>Acacia pachyacra</i>	+	2.50
<i>Aristida contorta</i>	+	0.60
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.55
<i>Bonamia erecta</i>	+	0.50
<i>Cenchrus ciliaris</i>	+	0.60
<i>Cleome viscosa</i>	+	0.70
<i>Corymbia hamersleyana</i>	+	4.00
<i>Cucumis maderaspatanus</i>	+	
<i>Cymbopogon oblectus</i>	+	0.70
<i>Dicrastylis cordifolia</i>	+	0.40
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.30
<i>Enneapogon polyphyllus</i>	+	0.60
<i>Eragrostis eriopoda</i>	+	0.60
<i>Eragrostis</i> sp.	+	0.50
<i>Eriachne aristidea</i>	+	0.20
<i>Eriachne pulchella</i>	+	0.20
<i>Eulalia aurea</i>	+	0.60
<i>Euphorbia australis</i>	+	0.20
<i>Goodenia microptera</i>	+	0.22
<i>Hakea chordophylla</i>	1	3.00
<i>Heliotropium chrysocarpum</i>	+	0.30
<i>Hibiscus leptocladus</i>	+	0.50
<i>Indigofera monophylla</i>	+	1.10m
<i>Marsdenia australis</i>	+	
<i>Mollugo molluginea</i>	+	0.10
<i>Paraneurachne muelleri</i>	+	0.70
<i>Petalostylis labicheoides</i>	+	2.00
<i>Polycarpaea longiflora</i>	+	0.50
<i>Portulaca oleracea</i>	+	prostrate
<i>Ptilotus astrolasius</i>	+	0.60
<i>Ptilotus calostachyus</i>	+	0.70
<i>Ptilotus exaltatus</i>	+	0.30

<i>Ptilotus helipteroides</i>	+	0.05
<i>Scaevola spinescens</i>	+	1.10
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	+	1.40
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	+	1.00
<i>Senna glutinosa</i> subsp. <i>x luerssenii</i>	+	1.60
<i>Sida arenicola</i>	+	0.40
<i>Solanum lasiophyllum</i>	+	0.60
<i>Trianthema glossostigma</i>	+	
<i>Trianthema pilosa</i>	+	0.15
<i>Triodia epactia</i>	+	1.00
<i>Triodia lanigera</i>	45	0.70
<i>Yakirra australiensis</i> var. <i>australiensis</i>	+	0.15

URS/IOH Iron Valley

Site

IOH06

Location: Iron Valley
m

Type: Q

50 x 50

1st Observation: Date: 10/04/2011 Described by: WT/NK

Seasonal Conditions: E

2nd Observation: Date: 3/08/2011 Described by: WTTDO

Seasonal Conditions: E

MGA Zone: 50 Easting: 736738 mE

Northing: 7485088 mN

Habitat: Lower slope - hill slope

Soil: Red brown shallow sandy loam

Rock Type: BIF

Vegetation: *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Triodia brizoides*, *T. epactia* hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: excellent

Fire Age: 2 - 5 years

Notes:

Species List

Name	% Cover	Height
<i>Acacia inaequilatera</i>	+	2.50
<i>Acacia maitlandii</i>	+	1.50
<i>Acacia tenuissima</i>	+	1.10
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.25
<i>Bulbostylis barbata</i>	+	0.15
<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	+	0.03
<i>Cleome viscosa</i>	+	0.30
<i>Corymbia hamersleyana</i>	+	4.00
<i>Crotalaria novae-hollandiae</i> subsp. <i>novae-hollandiae</i>	+	0.20
<i>Cymbopogon obtectus</i>	+	0.55
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.06
<i>Enneapogon lindleyanus</i>	+	0.40
<i>Enneapogon polyphyllus</i>	+	0.20
<i>Eriachne aristidea</i>	+	0.20
<i>Eriachne mucronata</i>	+	0.35
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	1	5.00
<i>Eulalia aurea</i>	+	0.50
<i>Fimbristylis microcarya</i>	+	0.30
<i>Gomphrena cunninghamii</i>	+	0.12
<i>Goodenia muelleriana</i>	+	0.05
<i>Gossypium australe</i>	+	1.20
<i>Grevillea wickhamii</i>	+	2.00
<i>Indigofera monophylla</i>	+	0.20
<i>Paspalidium clementii</i>	+	0.10
<i>Peripleura arida</i>	+	0.08
<i>Phyllanthus maderaspatensis</i>	+	0.03
<i>Polycarpaea longiflora</i>	+	0.25
<i>Polygala isingii</i>	+	0.03
<i>Ptilotus auriculifolius</i>	+	0.35
<i>Ptilotus exaltatus</i>	+	0.15
<i>Ptilotus obovatus</i>	+	0.60
<i>Rhynchosia minima</i>	+	0.30
<i>Schizachyrium fragile</i>	+	0.30
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.80
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	1.20

<i>Tribulus hirsutus</i>	+	0.40
<i>Trichodesma zeylanicum</i>	+	0.30
<i>Triodia brizoides</i>	37	0.75
<i>Triodia epactia</i>	3	0.80

URS/IOH Iron Valley

Site IOH07

Location: Iron Valley
m **Type:** Q 50 x 50

1st Observation: **Date:** 10/04/2011 **Described by:** NC/CW **Seasonal Conditions:** E

2nd Observation: **Date:** 31/07/2011 **Described by:** WTTDO **Seasonal Conditions:** E

MGA Zone: 50 **Easting:** 738999 mE **Northing:** 7485346 mN

Habitat: Open flat plain between hills to east and west

Soil: Red brown sandy loam

Rock Type: Ironstone

Vegetation: *Senna artemisioides* subsp. *helmsii*, *S. artemisioides* subsp. *oligophylla* low open shrubland over *Corchorus lasiocarpus* subsp. *parvus*, *Dicrastylis cordifolia*, *Trianthema pilosa* very open herbland over *Triodia lanigera* hummock grassland and *Paraneurachne muelleri* scattered

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 5 - 10 years

Notes: Occasional *Corymbia hamersleyana* and *Petalostylis labicheoides* adjacent to quadrat

Species List

Name	% Cover	Height
<i>Acacia ancistrocarpa</i>	+	0.90
<i>Acacia bivenosa</i>	+	2.0
<i>Acacia inaequilatera</i>	+	2.0
<i>Amphipogon sericeus</i>	+	0.25
<i>Aristida contorta</i>	+	0.50
<i>Bonamia erecta</i>	+	0.35
<i>Cleome viscosa</i>	+	0.50
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	1	0.40
<i>Dicrastylis cordifolia</i>	1	0.60
<i>Dodonaea coriacea</i>	+	1.20
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.05
<i>Eragrostis eriopoda</i>	+	0.40
<i>Eriachne aristidea</i>	+	0.25
<i>Eriachne mucronata</i>	+	0.50
<i>Eriachne pulchella</i>	+	0.15
<i>Euphorbia australis</i>	+	1.10
<i>Gomphrena affinis</i> subsp. <i>pilbarensis</i>	+	0.25
<i>Goodenia microptera</i>	+	0.50
<i>Goodenia stobbsiana</i>	+	0.45
<i>Hakea chordophylla</i>	+	2.50
<i>Haloragis gossei</i>	+	0.15
<i>Heliotropium chrysocarpum</i>	+	0.20
<i>Heliotropium cunninghamii</i>	+	0.20
<i>Hybanthus aurantiacus</i>	+	0.10
<i>Indigofera monophylla</i>	tussock grasses.	+ 0.20
<i>Mollugo molluginea</i>	+	0.15
<i>Paraneurachne muelleri</i>	2	0.60
<i>Ptilotus astrolasius</i>	+	0.45
<i>Ptilotus calostachyus</i>	+	0.70
<i>Ptilotus obovatus</i>	+	0.40
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	10	1.00
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	10	1.00
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	+	1.50
<i>Senna glutinosa</i> subsp. <i>x luerssenii</i>	+	1.70

<i>Senna notabilis</i>	+	0.25
<i>Sida arenicola</i>	+	0.50
<i>Sida</i> sp. Pilbara (A.A Mitchell PRP 1543)	+	0.30
<i>Trianthema glossostigma</i>	+	prostrate
<i>Trianthema pilosa</i>	1	0.10
<i>Tribulus macrocarpus</i>	+	prostrate
<i>Trichodesma zeylanicum</i>	+	0.25
<i>Triodia lanigera</i>	30	0.40
<i>Yakirra australiensis</i> var. <i>australiensis</i>	+	0.15

URS/IOH Iron Valley

Site

IOH08

Location: Iron Valley
m

Type: Q

50 x 50

1st Observation: Date: 11/04/2011 Described by: WT/NK

Seasonal Conditions: E

2nd Observation: Date: 31/07/2011 Described by: WTTDO

Seasonal Conditions: E

MGA Zone: 50 Easting: 739181 mE

Northing: 7485329 mN

Habitat: Flat - pediments/plain

Soil: Red brown shallo

Rock Type: BIF, weathered coarse fragments, no exposed bedrock

Vegetation: *Corymbia opaca* scattered low trees over *Acacia bivenosa* scattered tall shrubs over *A. ancistrocarpa* open shrubland over *Triodia basedowii* hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 2 - 5 years

Notes:

Species List

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.60
<i>Acacia adsurgens</i>	2	1.60
<i>Acacia ancistrocarpa</i>	+	1.50
<i>Acacia bivenosa</i>	1	4.0
<i>Acacia citrinoviridis</i>	+	2.20
<i>Acacia hilliana</i>	+	0.65
<i>Acacia inaequilatera</i>	+	1.60
<i>Acacia pruinocarpa</i>	+	2.00
<i>Acacia spondylophylla</i>	+	0.20
<i>Aristida contorta</i>	+	0.35
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.60
<i>Bonamia erecta</i>	+	0.30
<i>Cenchrus ciliaris</i>	+	0.30
<i>Cleome viscosa</i>	+	0.40
<i>Corymbia deserticola</i>	+	4.50
<i>Corymbia opaca</i>	1	5.00
<i>Cucumis maderaspatanus</i>	+	1.00
<i>Dicrastylis cordifolia</i>	+	0.30
<i>Dodonaea coriacea</i>	+	1.00
<i>Dysphania kalpari</i>	+	0.06
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.70
<i>Eriachne aristidea</i>	+	0.40
<i>Eriachne pulchella</i>	+	0.25
<i>Eucalyptus gamophylla</i>	+	2.10
<i>Euphorbia australis</i>	+	0.06
<i>Goodenia microptera</i>	+	0.18

<i>Grevillea wickhamii</i>	+	0.10
<i>Hakea chordophylla</i>	+	3.50
<i>Hybanthus aurantiacus</i>	+	0.50
<i>Indigofera monophylla</i>	+	0.20
<i>Mollugo molluginea</i>	+	0.06
<i>Paspalidium basicladum</i>	+	0.35
<i>Petalostylis labicheoides</i>	+	1.30
<i>Phyllanthus maderaspatensis</i>	+	0.10
<i>Ptilotus astrolasius</i>	+	0.20
<i>Ptilotus calostachyus</i>	+	0.40
<i>Rhyncharrhena linearis</i>	+	1.00
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.45
<i>Senna glutinosa</i> subsp. x <i>luerssenii</i>	+	1.60
<i>Senna notabilis</i>	+	0.30
<i>Sida arenicola</i>	+	0.10
<i>Sida cardiophylla</i>	+	0.10
<i>Trianthema glossostigma</i>	+	0.05
<i>Trianthema pilosa</i>	+	0.10
<i>Tribulus hirsutus</i>	+	0.06
<i>Trichodesma zeylanicum</i>	+	0.18
<i>Triodia basedowii</i>	40	1.00
<i>Triodia epactia</i>	+	0.60

URS/IOH Iron Valley

Site

IOH09

Location: Iron Valley
m

Type: Q

50 x 50

1st Observation: Date: 10/04/2011 Described by: NC/CW

Seasonal Conditions: E

2nd Observation: Date: 3/08/2011 Described by: WTTDO

Seasonal Conditions: E

MGA Zone: 50 Easting: 738696 mE

Northing: 7485474 mN

Habitat: Open flat plain

Soil: Red brown sandy loam

Rock Type: Ironstone

Vegetation: *Acacia inaequilatera* scattered tall shrubs and *Eucalyptus gamophylla* low open woodland over *Petalostylis labicheoides* scattered shrubs over *Triodia basedowii* open hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 5 -10 yrs

Notes:

Species List

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.60
<i>Acacia adsurgens</i>	+	1.30
<i>Acacia ancistrocarpa</i>	+	2.00
<i>Acacia bivenosa</i>	+	3.5
<i>Acacia citrinoviridis</i>	+	2.00
<i>Acacia dictyophleba</i>	+	0.60
<i>Acacia inaequilatera</i>	1	3.50
<i>Anthobolus leptomerioides</i>	+	2.2
<i>Aristida contorta</i>	+	0.2
<i>Aristida hygrometrica</i>	+	0.50
<i>Aristida inaequiglumis</i>	+	0.5
<i>Boerhavia coccinea</i>	+	prostrate
<i>Bonamia erecta</i>	+	0.50
<i>Cenchrus ciliaris</i>	+	1.00
<i>Chrysopogon fallax</i>	+	1.40
<i>Cleome viscosa</i>	+	0.50
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	0.30
<i>Corchorus tectus</i>	+	0.30
<i>Cucumis maderaspatanus</i>	+	climber
<i>Dicrastylis cordifolia</i>	+	0.20
<i>Enneapogon polyphyllus</i>	+	0.50
<i>Eragrostis eriopoda</i>	+	0.50
<i>Eriachne aristidea</i>	+	0.4
<i>Eucalyptus gamophylla</i>	2	3.0
<i>Euphorbia australis</i>	+	0.05

<i>Euphorbia biconvexa</i>	+	0.3
<i>Goodenia microptera</i>	+	0.06
<i>Grevillea wickhamii</i>	+	.1
<i>Hakea lorea</i>	+	3.5
<i>Haloragis gossei</i>	+	0.15
<i>Hibiscus sturtii</i> var. <i>platyklamys</i>	+	0.5
<i>Hybanthus aurantiacus</i>	+	0.3
<i>Marsdenia australis</i>	+	climber
<i>Mollugo molluginea</i>	+	0.2
<i>Petalostylis labicheoides</i>	1	1.5
<i>Portulaca oleracea</i>	+	0.15
<i>Ptilotus auriculifolius</i>	+	0.4
<i>Ptilotus exaltatus</i>	+	0.4
<i>Ptilotus polystachyus</i>	+	0.55
<i>Rhynchosia minima</i>	+	0.1
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	+	0.6
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	+	1.3
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.5
<i>Senna notabilis</i>	+	0.15
<i>Setaria dielsii</i>	+	0.5
<i>Sida arenicola</i>	+	0.1
<i>Solanum sturtianum</i>	+	0.6
<i>Trianthema pilosa</i>	+	prostrate
<i>Tribulus macrocarpus</i>	+	0.05
<i>Trichodesma zeylanicum</i>	+	0.15
<i>Triodia basedowii</i>	30	0.4
<i>Yakirra australiensis</i> var. <i>australiensis</i>	+	0.15

URS/IOH Iron Valley

Site

IOH10

Location: Iron Valley
m

Type: Q

50 x 50

1st Observation: Date: 11/04/2011 Described by: WNNC

Seasonal Conditions: E

2nd Observation: Date: 1/08/2011 Described by: WTTDO

Seasonal Conditions: E

MGA Zone: 50 Easting: 738841 mE

Northing: 7484867 mN

Habitat: Crest of rock outcrop

Soil: Red brown, skeletal and shallow

Rock Type: BIF seam, exposed bedrock

Vegetation: *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Senna glutinosa* subsp. *pruinosa* scattered shrubs over *Triodia lanigera*, *T. wiseana* open hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 2 - 5 years

Notes:

Species List

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.5
<i>Acacia bivenosa</i>	+	2.5
<i>Acacia dictyophleba</i>	+	1.6
<i>Acacia inaequilatera</i>	+	3.0
<i>Acacia pachyacra</i>	+	1.6
<i>Aristida holathera</i> var. <i>holathera</i>	0.5	+
<i>Cleome viscosa</i>	+	0.3
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	0.4
<i>Corymbia hamersleyana</i>	+	5
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.6
<i>Eriachne mucronata</i>	+	0.2
<i>Eriachne pulchella</i>	+	0.1
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	2	5
<i>Fimbristylis simulans</i>	+	0.2
<i>Gomphrena cunninghamii</i>	+	0.25
<i>Goodenia microptera</i>	+	0.2
<i>Hakea chordophylla</i>	+	1.8
<i>Mollugo molluginea</i>	+	0.6
<i>Paraneurachne muelleri</i>	+	0.3
<i>Polycarpaea corymbosa</i>	+	0.06
<i>Polycarpaea holtzei</i>	+	0.03
<i>Ptilotus exaltatus</i>	+	0.2
<i>Rhyncharrhena linearis</i>	+	1.5
<i>Santalum lanceolatum</i>	+	1.8
<i>Scaevola parvifolia</i> subsp. <i>pilbarae</i>	+	0.15
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.5
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	1	1.4
<i>Sporobolus australasicus</i>	+	0.1
<i>Trianthema glossostigma</i>	+	0.02
<i>Tribulus hirsutus</i>	+	0.08
<i>Triodia lanigera</i>	12	0.4
<i>Triodia wiseana</i>	10	0.5

URS/IOH Iron Valley

Site

IOH11r

Location: Iron Valley

Type: R

1st Observation: Date: 11/04/2011

Described by: NC/CW

Seasonal Conditions: E

2nd Observation: Date: 2/08/2011

Described by: WTTDO

Seasonal Conditions: E

MGA Zone: Easting: mE

Northing: mN

Habitat: Open flat plain

Soil: Orange brown sandy loam

Rock Type: N/A

Vegetation: *Acacia ancistrocarpa* tall open shrubland over *Petalostylis labicheoides* scattered shrubs over *Triodia lanigera* hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: > 10 yrs

Notes:

Species List

Name	% Cover	Height
<i>Acacia adsurgens</i>	+	1.2
<i>Acacia ancistrocarpa</i>	2	2.5
<i>Acacia dictyophleba</i>	+	1.4
<i>Acacia pachyacra</i>	+	2.5
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.35
<i>Bonamia erecta</i>	+	0.25
<i>Cleome viscosa</i>	+	0.3
<i>Corchorus tectus</i>	+	0.3
<i>Cucumis maderaspatanus</i>	+	climber
<i>Cullen lachnostachys</i>	+	0.1
<i>Dicrastylis cordifolia</i>	+	0.4
<i>Dysphania kalpari</i>	+	0.2
<i>Eriachne aristidea</i>	+	0.22
<i>Euphorbia australis</i>	+	0.15
<i>Gomphrena cunninghamii</i>	+	0.1
<i>Grevillea wickhamii</i>	+	2.5
<i>Hakea chordophylla</i>	+	2.0
<i>Hakea lorea</i>	+	2.0
<i>Indigofera monophylla</i>	+	0.6
<i>Petalostylis labicheoides</i>	1	2.0
<i>Phyllanthus maderaspatensis</i>	+	0.1
<i>Senna notabilis</i>	+	0.15
<i>Sida arenicola</i>	+	0.15
<i>Sida</i> sp. Pilbara (A.A Mitchell PRP 1543)	+	0.07
<i>Trianthema pilosa</i>	+	0.05
<i>Triodia lanigera</i>	60	0.45
<i>Velleia connata</i>	+	0.25
<i>Yakirra australiensis</i> var. <i>australiensis</i>	+	0.15

URS/IOH Iron Valley

Site

IOH12

Location: Iron Valley
m

Type: Q

50 x 50

1st Observation: Date: 11/08/2011 Described by: WT/NK

Seasonal Conditions: E

2nd Observation: Date: 31/07/2011 Described by: WTTDO

Seasonal Conditions: E

MGA Zone: 50 Easting: 738127 mE

Northing: 7484583 mN

Habitat: Flat colluvial plain

Soil: Red brown

Rock Type: Ironstone gravel, coarse fragments of cobble size

Vegetation: *Eucalyptus gamophylla* scattered low trees over *Triodia basedowii*, *T. wiseana*, *T. epactia* open hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 0 -2 yrs

Notes:

Species List

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.6
<i>Acacia ancistrocarpa</i>	+	1
<i>Acacia bivenosa</i>	+	7.5
<i>Acacia inaequilatera</i>	+	3.5
<i>Acacia pruinocarpa</i>	+	1.5
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.3
<i>Cleome viscosa</i>	+	0.3
<i>Dicrastylis cordifolia</i>	+	0.5
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.06
<i>Eriachne mucronata</i>	+	0.2
<i>Eriachne pulchella</i>	+	0.08
<i>Eucalyptus gamophylla</i>	1	3.5
<i>Euphorbia australis</i>	+	0.25
<i>Fimbristylis simulans</i>	+	0.2
<i>Gomphrena affinis</i> subsp. <i>pilbarensis</i>	+	0.2
<i>Gomphrena cunninghamii</i>	+	0.15
<i>Goodenia microptera</i>	+	0.15
<i>Grevillea wickhamii</i>	+	2.5
<i>Hakea chordophylla</i>	+	4
<i>Hakea lorea</i>	+	2.0
<i>Heliotropium chrysocarpum</i>	+	0.8
<i>Hybanthus aurantiacus</i>	+	0.35
<i>Indigofera monophylla</i>	+	0.2
<i>Mollugo molluginea</i>	+	0.08
<i>Paraneurachne muelleri</i>	+	0.5
<i>Paspalidium basicladum</i>	+	0.4

<i>Polycarpaea corymbosa</i>	+	0.08
<i>Polycarpaea holtzei</i>	+	0.04
<i>Portulaca oleracea</i>	+	0.04
<i>Ptilotus auriculifolius</i>	+	0.2
<i>Ptilotus calostachyus</i>	+	0.35
<i>Ptilotus exaltatus</i>	+	0.35
<i>Ptilotus obovatus</i>	+	0.35
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	+	0.75
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.8
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	+	1.4
<i>Senna notabilis</i>	+	0.08
<i>Sida arenicola</i>	+	0.8
<i>Trianthema glossostigma</i>	+	0.03
<i>Trichodesma zeylanicum</i>	+	0.45
<i>Triodia basedowii</i>	25	0.45
<i>Triodia epactia</i>	1	0.6
<i>Triodia wiseana</i>	2	0.5

URS/IOH Iron Valley

Site

IOH13

Location: Northern end of survey area
m**Type:** Q

50 x 50

1st Observation: **Date:** 11/04/2011 **Described by:** NC/CW**Seasonal Conditions:** E**2nd Observation:** **Date:** 3/08/2011 **Described by:** WTTDO**Seasonal Conditions:** E**MGA Zone:** 50 **Easting:** 739340 mE**Northing:** 7485682 mN**Habitat:** Open flat plain**Soil:** Orange brown sandy loam/fine sand**Rock Type:****Vegetation:** *Acacia ancistrocarpa* tall open shrubland over *Triodia lanigera* hummock grassland.**Vegetation Code:****Vegetation Desc:****Veg Condition:** Excellent**Fire Age:** 5 - 10 yrs**Notes:** *Petalostylis labicheoides* almost constitutes 1%

Species List

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.55
<i>Acacia ancistrocarpa</i>	2	2.2
<i>Acacia citrinoviridis</i>	+	0.2
<i>Acacia dictyophleba</i>	+	3
<i>Acacia inaequilatera</i>	+	2.5
<i>Acacia pachyacra</i>	+	0.7
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.5
<i>Bonamia erecta</i>	+	0.4
<i>Cleome viscosa</i>	+	0.5
<i>Corchorus tectus</i>	+	0.15
<i>Cucumis maderaspatanus</i>	+	0.08
<i>Dicrastylis cordifolia</i>	+	0.4
<i>Dodonaea coriacea</i>	+	0.2
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.12
<i>Eriachne aristidea</i>	+	0.3
<i>Euphorbia australis</i>	+	0.2
<i>Gomphrena cunninghamii</i>	+	0.08
<i>Goodenia microptera</i>	+	0.3
<i>Grevillea wickhamii</i>	+	2
<i>Hakea chordophylla</i>	+	3.5
<i>Hakea lorea</i>	+	2
<i>Hybanthus aurantiacus</i>	+	0.3
<i>Petalostylis labicheoides</i>	+	1.4
<i>Phyllanthus maderaspatensis</i>	+	0.4
<i>Ptilotus helipteroides</i>	+	0.12
<i>Scaevola parvifolia</i> subsp. <i>pilbarae</i>	+	0.3
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.7
<i>Senna notabilis</i>	+	0.2
<i>Sida</i> sp. Pilbara (A.A Mitchell PRP 1543)	+	0.15
<i>Sonchus oleraceus</i>	+	0.1
<i>Triodia lanigera</i>	60	0.5
<i>Velleia connata</i>	+	0.3
<i>Yakirra australiensis</i> var. <i>australiensis</i>	+	0.05

URS/IOH Iron Valley

Site IOH14

Location: South of central heritage site
m **Type:** Q 50 x 50

1st Observation: **Date:** 12/04/2011 **Described by:** WT/NK **Seasonal Conditions:** E

2nd Observation: **Date:** 30/07/2011 **Described by:** WTTDO **Seasonal Conditions:** E

MGA Zone: 50 **Easting:** 737177 mE **Northing:** 7484129 mN

Habitat: Lower slope of ridge

Soil: Red brown skeletal sandy loam

Rock Type: BIF, weathered with some metamorphic rock

Vegetation: *Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over *Hakea lorea* scattered tall shrubs over *Acacia hilliana* scattered low shrubs over *Triodia lanigera*, *T. epactia* open hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: excellent

Fire Age: 0 - 2 yrs

Notes:

Species List

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.7
<i>Acacia bivenosa</i>	+	2
<i>Acacia hilliana</i>	1	0.4
<i>Acacia inaequilatera</i>	+	1
<i>Acacia pruinocarpa</i>	+	1.6
<i>Acacia pyrifolia</i>	+	0.7
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.2
<i>Bulbostylis barbata</i>	+	0.12
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.04
<i>Enneapogon polyphyllus</i>	+	0.15
<i>Eriachne lanata</i>	+	0.1
<i>Eriachne mucronata</i>	+	0.45
<i>Eriachne pulchella</i>	+	0.15
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	3	4
<i>Fimbristylis simulans</i>	+	0.2
<i>Gomphrena cunninghamii</i>	+	0.1
<i>Goodenia stobbsiana</i>	+	0.08
<i>Goodenia triodiophila</i>	+	0.4
<i>Grevillea wickhamii</i>	+	0.7
<i>Hakea chordophylla</i>	1	4
<i>Paspalidium clementii</i>	+	0.5
<i>Polycarpaea holtzei</i>	+	0.06
<i>Polycarpaea longiflora</i>	+	0.12
<i>Polygala isingii</i>	+	0.03
<i>Polymeria ambigua</i>	+	0.08
<i>Ptilotus calostachyus</i>	+	0.25
<i>Ptilotus exaltatus</i>	+	0.1
<i>Schizachyrium fragile</i>	+	0.45
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.65
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	+	1
<i>Senna glutinosa</i> subsp. x <i>luerssenii</i>	+	1.3
<i>Solanum ellipticum</i>	+	0.3
<i>Tephrosia</i> sp. Cathedral Gorge (F.H. Mollemans 2420)	+	0.08
<i>Trianthema glossostigma</i>	+	0.01

<i>Trichodesma zeylanicum</i>	+	0.2
<i>Triodia epactia</i>	5	0.45
<i>Triodia lanigera</i>	18	0.3

URS/IOH Iron Valley

Site IOH15

Location: One kilometre south of camp m **Type:** Q 50 x 50

1st Observation: **Date:** 11/04/2011 **Described by:** NC/CW **Seasonal Conditions:** E

2nd Observation: **Date:** 1/08/2011 **Described by:** WTTDO **Seasonal Conditions:** E

MGA Zone: 50 **Easting:** 738583 mE **Northing:** 7484694 mN

Habitat: Crest and upper slopes (east and west) of low hill

Soil: Orange brown sandy loam

Rock Type: Ironstone rocks and some outcropping / shales

Vegetation: *Eucalyptus leucophloia* scattered low trees over *Triodia* sp. Shovelanna Hill hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: excellent

Fire Age: 5 - 10 yrs

Notes: Potential Pebble-Mound Mouse (*Pseudomys chapmani*) mound in quadrat, both likely active, Photos 341 and 342 camera 9 respectively.

Species List

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	
<i>Acacia bivenosa</i>	+	3.0
<i>Acacia dictyophleba</i>	+	0.9
<i>Acacia inaequilatera</i>	+	3.0
<i>Amphipogon sericeus</i>	+	0.25
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.25
<i>Bonamia media</i> var. <i>villosa</i>	+	creeper
<i>Calytrix carinata</i>	+	0.7
<i>Cleome viscosa</i>	+	0.15
<i>Eriachne mucronata</i>	+	0.3
<i>Eriachne pulchella</i>	+	0.1
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	1	4.0
<i>Fimbristylis simulans</i>	+	0.1
<i>Goodenia stobbsiana</i>	+	0.2
<i>Goodenia triodiophila</i>	+	0.3
<i>Grevillea wickhamii</i> subsp. <i>hispidula</i>	+	2.2
<i>Hakea chordophylla</i>	+	2.0
<i>Hibiscus sturtii</i> var. <i>campylochlamys</i>	+	0.15
<i>Indigofera monophylla</i>	+	0.45
<i>Mollugo molluginea</i>	+	0.08
<i>Paraneurachne muelleri</i>	+	0.4
<i>Petalostylis labicheoides</i>	+	1.8
<i>Polycarpaea holtzei</i>	+	0.05
<i>Ptilotus calostachyus</i>	+	0.7
<i>Ptilotus exaltatus</i>	+	0.1
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.9
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	0.8
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	+	1.0
<i>Senna glutinosa</i> subsp. x <i>luerssenii</i>	+	1.0
<i>Trianthema pilosa</i>	+	0.03
<i>Tribulus suberosus</i>	+	0.7
<i>Triodia</i> sp. Shovelanna Hill (S. van Leeuwen 3835)	55	0.25
<i>Triodia wiseana</i>	+	0.15

URS/IOH Iron Valley

Site IOH16

Location: Between heritage areas
m **Type:** Q 50 x 50

1st Observation: **Date:** 12/04/2011 **Described by:** WT/NK **Seasonal Conditions:** E

2nd Observation: **Date:** 30/07/2011 **Described by:** WTTDO **Seasonal Conditions:** E

MGA Zone: 50 **Easting:** 736907 mE **Northing:** 7484008 mN

Habitat: Mid slope of hill/ridge

Soil: Red brown skeletal loamy sand/sandy loam

Rock Type: BIF outcrop

Vegetation: *Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over *Acacia pruinocarpa* scattered tall shrubs over *A. hilliana* low open shrubland over *Triodia lanigera*, *T. epactia* open hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: excellent

Fire Age: 0 - 2 yrs

Notes:

Species List

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.65
<i>Acacia bivenosa</i>	+	3
<i>Acacia hilliana</i>	2	0.5
<i>Acacia inaequilatera</i>	+	1
<i>Acacia pruinocarpa</i>	1	2.5
<i>Acacia pyrifolia</i>	+	1.6
<i>Bulbostylis barbata</i>	+	0.06
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	0.5
<i>Dodonaea coriacea</i>	+	1
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.08
<i>Eriachne lanata</i>	+	0.4
<i>Eriachne mucronata</i>	+	0.15
<i>Eriachne pulchella</i>	+	0.15
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	4	4
<i>Fimbristylis simulans</i>	+	0.12
<i>Gomphrena cunninghamii</i>	+	0.08
<i>Goodenia stobbsiana</i>	+	0.06
<i>Goodenia triodiophila</i>	+	0.25
<i>Grevillea wickhamii</i>	+	1.8
<i>Hakea lorea</i>	+	2
<i>Mirbelia viminalis</i>	+	0.7
<i>Paspalidium clementii</i>	+	0.06
<i>Polycarpaea holtzei</i>	+	0.04
<i>Ptilotus calostachyus</i>	+	0.35
<i>Schizachyrium fragile</i>	+	0.25
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	+	1.2
<i>Senna glutinosa</i> subsp. <i>x luerssenii</i>	+	1.3
<i>Solanum ellipticum</i>	+	0.07
<i>Trichodesma zeylanicum</i>	+	0.18
<i>Triodia epactia</i>	4	0.4
<i>Triodia lanigera</i>	13	0.4

URS/IOH Iron Valley

Site

IOH17

Location: 150 metres east of track
m**Type:** Q

50 x 50

1st Observation: **Date:** 11/04/2011 **Described by:** NC/CW**Seasonal Conditions:** E**2nd Observation:** **Date:** 1/08/2011 **Described by:** WTTDO**Seasonal Conditions:** E**MGA Zone:** 50 **Easting:** 738397 mE**Northing:** 7484409 mN**Habitat:** Open flat outwash plain**Soil:** Red brown sandy loam**Rock Type:****Vegetation:** *Triodia lanigera* open hummock grassland and *Paraneurachne muelleri* scattered tussock grasses.**Vegetation Code:****Vegetation Desc:****Veg Condition:** Excellent**Fire Age:** 2 - 5 yrs**Notes:** *Corymbia hamersleyana* and *Acacia ancistrocarpa* adjacent to quadrat

Species List

Name	% Cover	Height
	+	0.4
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.4
<i>Acacia ancistrocarpa</i>	+	1.4
<i>Acacia bivenosa</i>	+	2.1
<i>Acacia dictyophleba</i>	+	0.8
<i>Acacia hilliana</i>	+	0.55
<i>Acacia inaequilatera</i>	+	1.5
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.2
<i>Aristida inaequiglumis</i>	+	1
<i>Bonamia erecta</i>	+	0.5
<i>Cleome viscosa</i>	+	0.45
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	0.4
<i>Dicrastylis cordifolia</i>	+	0.7
<i>Dodonaea coriacea</i>	+	0.65
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.04
<i>Enneapogon polyphyllus</i>	+	0.5
<i>Eragrostis eriopoda</i>	+	0.6
<i>Euphorbia australis</i>	+	0.1
<i>Goodenia microptera</i>	+	0.05
<i>Goodenia stobbsiana</i>	+	0.12
<i>Grevillea wickhamii</i>	+	1.3
<i>Haloragis gossei</i>	+	0.15
<i>Heliotropium chrysocarpum</i>	+	0.2
<i>Hybanthus aurantiacus</i>	+	0.45
<i>Mollugo molluginea</i>	+	0.07
<i>Paraneurachne muelleri</i>	1	0.6
<i>Petalostylis labicheoides</i>	+	1.1

<i>Polycarpaea holtzei</i>	+	0.05
<i>Portulaca oleracea</i>	+	0.2
<i>Ptilotus astrolasius</i>	+	0.2
<i>Ptilotus calostachyus</i>	+	0.35
<i>Ptilotus exaltatus</i>	+	0.2
<i>Ptilotus polystachyus</i>	+	0.17
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	+	1.1
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	1.1
<i>Senna glutinosa</i> subsp. x <i>luerssenii</i>	+	1
<i>Senna notabilis</i>	+	0.15
<i>Sida cardiophylla</i>	+	1.2
<i>Solanum sturtianum</i>	+	0.6
<i>Trianthema pilosa</i>	+	0.3
<i>Triodia lanigera</i>	30	0.6
<i>Yakirra australiensis</i> var. <i>australiensis</i>	+	0.04

URS/IOH Iron Valley

Site

IOH18

Location:
m

Type: Q

50 x 50

1st Observation: Date: 12/04/2011 Described by: WT/NK

Seasonal Conditions: E

2nd Observation: Date: 1/08/2011 Described by: WTTDO

Seasonal Conditions: E

MGA Zone: 50

Easting: 738500 mE

Northing: 7483983 mN

Habitat: Mid-lower slope of undulating hills, edge of outcrop with larged boulders on east side of

Soil: Red brown shallow sandy loam

Rock Type: Weathered ironstone

Vegetation: *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Acacia bivenosa*
scattered tall shrubs over *Triodia epactia*, *T. wiseana* and *T. lanigera* hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age:

Notes:

Species List

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.45
<i>Acacia bivenosa</i>	1	4
<i>Acacia hilliana</i>	+	0.45
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.25
<i>Bonamia erecta</i>	+	0.12
<i>Bulbostylis barbata</i>	+	0.1
<i>Corymbia hamersleyana</i>	extern	3.5
<i>Eriachne pulchella</i>	+	0.1
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	1	4.5
<i>Euphorbia australis</i>	+	0.1
<i>Fimbristylis simulans</i>	+	0.12
<i>Gomphrena affinis</i> subsp. <i>pilbarensis</i>	+	0.12
<i>Goodenia triodiophila</i>	+	0.3
<i>Grevillea wickhamii</i>	+	0.1
<i>Hybanthus aurantiacus</i>	+	0.1
<i>Indigofera monophylla</i>	+	0.16
<i>Polycarpaea corymbosa</i>	+	0.1
<i>Polycarpaea holtzei</i>	+	0.04
<i>Polygala isingii</i>	+	0.04
<i>Ptilotus calostachyus</i>	+	0.18
<i>Ptilotus exaltatus</i>	+	0.08
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	1.2
<i>Senna glutinosa</i> subsp. x <i>luerssenii</i>	+	1.2
<i>Senna notabilis</i>	+	0.1
<i>Trianthema glossostigma</i>	+	0.02
<i>Triodia epactia</i>	16	0.7
<i>Triodia lanigera</i>	1	0.45
<i>Triodia wiseana</i>	16	0.55

URS/IOH Iron Valley

Site

IOH19

Location: Southeast of non circular aboriginal heritage area **Type:** Q 50 x 50 m

1st Observation: **Date:** 12/04/2011 **Described by:** NC/CW **Seasonal Conditions:** E

2nd Observation: **Date:** **Described by:** WTTDO **Seasonal Conditions:** E

MGA Zone: 50 **Easting:** 737762 mE **Northing:** 7483970 mN

Habitat: Open plat plain in between hills to east and west

Soil: Orange brown clayey sand

Rock Type: Ironstone cobbles and rocks

Vegetation: *Bonamia rosea*, *Keraudrenia nephrosperma* low open shrubland over *Triodia epactia*, *T. lanigera* very open hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 2 - 5 yrs

Notes: Vegetation adjacent to quadrat disturbed by fire and drilling

Species List

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	
<i>Acacia ancistrocarpa</i>	+	0.5
<i>Acacia citrinoviridis</i>	+	0.75
<i>Acacia inaequilatera</i>	+	0.8
<i>Acacia pachyacra</i>	+	0.15
<i>Acacia tumida</i> var. <i>pilbarensis</i>	+	0.5
<i>Amphipogon sericeus</i>	+	0.25
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.2
<i>Bonamia erecta</i>	2	0.5
<i>Bulbostylis barbata</i>	+	0.07
<i>Cleome viscosa</i>	+	0.7
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	1.2
<i>Corymbia hamersleyana</i>	+	4.5
<i>Dicrastylis cordifolia</i>	+	0.8
<i>Dodonaea coriacea</i>	+	0.5
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.1
<i>Eragrostis eriopoda</i>	+	0.3
<i>Eriachne aristidea</i>	+	0.25
<i>Eriachne pulchella</i>	+	0.2
<i>Eucalyptus gamophylla</i>	+	1.5
<i>Euphorbia australis</i>	+	0.05
<i>Fimbristylis simulans</i>	+	0.08
<i>Goodenia microptera</i>	+	0.07

<i>Gossypium australe</i>	+	0.5
<i>Grevillea wickhamii</i>	+	1
<i>Hakea chordophylla</i>	+	2.0
<i>Hakea lorea</i>	+	0.75
<i>Heliotropium chrysocarpum</i>	+	0.15
<i>Hibiscus sturtii</i> var. <i>campylochlamys</i>	+	0.3
<i>Hibiscus sturtii</i> var. <i>platychlamys</i>	+	0.25
<i>Hybanthus aurantiacus</i>	+	0.3
<i>Indigofera monophylla</i>	+	0.4
<i>Keraudrenia nephrosperma</i>	1	0.5
<i>Mollugo molluginea</i>	+	0.1
<i>Paraneurachne muelleri</i>	+	0.4
<i>Petalostylis labicheoides</i>	+	1.3
<i>Phyllanthus maderaspatensis</i>		
<i>Polycarpaea corymbosa</i>	+	0.1
<i>Polycarpaea holtzei</i>	+	0.1
<i>Ptilotus calostachyus</i>	+	0.4
<i>Ptilotus exaltatus</i>	+	0.5
<i>Scaevola parvifolia</i> subsp. <i>pilbarae</i>	+	0.25
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	+	0.5
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	0.1
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	+	1.2
<i>Senna notabilis</i>	+	0.07
<i>Sida</i> sp. Pilbara (A.A Mitchell PRP 1543)	+	0.35
<i>Solanum phlomoides</i>	+	0.2
<i>Themeda triandra</i>	+	0.8
<i>Trianthema glossostigma</i>	+	prostrate
<i>Trianthema pilosa</i>	+	0.1
<i>Tribulopsis angustifolia</i>	+	prostrate
<i>Trichodesma zeylanicum</i>	+	0.3
<i>Triodia brizoides</i>	2	0.3
<i>Triodia epactia</i>	8	0.4
<i>Triodia lanigera</i>	+	0.3
<i>Yakirra australiensis</i> var. <i>australiensis</i>	+	0.08

URS/IOH Iron Valley

Site

IOH20

Location:

m

Type: Q

50 x 50

1st Observation: Date: 12/08/2011 Described by: WT/NK

Seasonal Conditions: E

2nd Observation: Date: 1/08/2011 Described by: WTTDO

Seasonal Conditions: E

MGA Zone: 50 Easting: 738277 mE

Northing: 7484145 mN

Habitat: Pediment - depression

Soil: Red brown shallow sandy loam

Rock Type: Weathered ironstone or basalt

Vegetation: *Grevillea wickhamii* scattered tall shrubs over *Acacia ancistrocarpa* scattered shrubs over *Triodia wiseana*, *T. lanigera* very open hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 2 - 5 yrs

Notes:

Species List

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.75
<i>Acacia ancistrocarpa</i>	1	2
<i>Acacia bivenosa</i>	+	4
<i>Acacia citrinoviridis</i>	+	4.2
<i>Acacia hilliana</i>	+	0.75
<i>Acacia inaequilatera</i>	+	2.2
<i>Acacia pyrifolia</i>	+	1.2
<i>Amphipogon sericeus</i>	+	0.18
<i>Aristida contorta</i>	+	0.35
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.4
<i>Bonamia erecta</i>	+	0.2
<i>Bonamia rosea</i>	+	1.2
<i>Bulbostylis barbata</i>	+	0.08
<i>Cleome viscosa</i>	+	0.2
<i>Corchorus lasiocarpus</i> subsp. <i>lasiocarpus</i>	+	1.1
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.12
<i>Eragrostis eriopoda</i>	+	0.5
<i>Eriachne mucronata</i>	+	0.45
<i>Eriachne pulchella</i>	+	0.15
<i>Euphorbia australis</i>	+	0.15
<i>Goodenia microptera</i>	+	0.3
<i>Goodenia muelleriana</i>	+	0.3
<i>Goodenia stobbsiana</i>	+	0.5
<i>Grevillea wickhamii</i>	1	4

<i>Hakea chordophylla</i>	+	2.5
<i>Hakea lorea</i>	+	1.4
<i>Heliotropium chrysocarpum</i>	+	0.15
<i>Hybanthus aurantiacus</i>	+	0.4
<i>Indigofera monophylla</i>	+	0.35
<i>Mollugo molluginea</i>	+	0.1
<i>Paraneurachne muelleri</i>	+	0.4
<i>Petalostylis labicheoides</i>	+	1.5
<i>Polycarpaea corymbosa</i>	+	0.1
<i>Polycarpaea holtzei</i>	+	0.05
<i>Polygala isingii</i>	+	0.04
<i>Portulaca oleracea</i>	+	0.03
<i>Ptilotus auriculifolius</i>	+	0.3
<i>Ptilotus calostachyus</i>	+	0.1
<i>Ptilotus exaltatus</i>	+	0.42
<i>Ptilotus obovatus</i>	+	0.18
<i>Schizachyrium fragile</i>	+	0.4
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	+	0.5
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.6
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	1.2
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	+	0.6
<i>Senna glutinosa</i> subsp. x <i>luerssenii</i>	+	0.8
<i>Senna notabilis</i>	+	0.12
<i>Sida arenicola</i>	+	0.2
<i>Solanum lasiophyllum</i>	+	0.5
<i>Trianthema glossostigma</i>	+	0.04
<i>Tribulus hirsutus</i>	+	0.1
<i>Trichodesma zeylanicum</i>	+	0.15
<i>Triodia lanigera</i>	1	0.3
<i>Triodia schinzii</i>	+	0.4
<i>Triodia wiseana</i>	8	0.6
<i>Yakirra australiensis</i> var. <i>australiensis</i>	+	0.08

URS/IOH Iron Valley

Site

IOH21

Location: East of track south from camp
m**Type:** Q

50 x 50

1st Observation: **Date:** 12/04/2011 **Described by:** NC/CW**Seasonal Conditions:** E**2nd Observation:** **Date:** 30/07/2011 **Described by:** WTTDO**Seasonal Conditions:** E**MGA Zone:** 50**Easting:** 737959 mE**Northing:** 7483841 mN**Habitat:** Lower and middle slope of northwest facing simple slope**Soil:** Orange brown clayey sand**Rock Type:** Ironstone rocks and outcrops**Vegetation:** *Acacia hilliana* shrubland over *Triodia* sp. Shovelanna Hill and *T. wiseana* open hummock grassland.**Vegetation Code:****Vegetation Desc:****Veg Condition:** Excellent**Fire Age:** 2 -5 yrs**Notes:** Pebble-Mound Mouse (*Pseudomys chapmani*) mound, very likely active, in southeast of

Species List

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.4
<i>Acacia ancistrocarpa</i>	extern	0.8
<i>Acacia bivenosa</i>	+	
<i>Acacia citrinoviridis</i>	+	0.45
<i>Acacia dictyophleba</i>	+	0.45
<i>Acacia hilliana</i>	20	0.5
<i>Acacia inaequilatera</i>	+	1.8
<i>Acacia pachyacra</i>	+	0.45
<i>Acacia pruinocarpa</i>	+	0.3
<i>Amphipogon sericeus</i>	+	0.25
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.25
<i>Bonamia media</i> var. <i>villosa</i>	+	0.07
<i>Bulbostylis barbata</i>	+	0.06
<i>Calytrix carinata</i>	+	0.15
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	0.7
<i>Corymbia hamersleyana</i>	+	0.15
<i>Dodonaea coriacea</i>	+	0.7
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.1
<i>Eriachne lanata</i>	+	0.25
<i>Eriachne mucronata</i>	+	0.5
<i>Eriachne pulchella</i>	+	0.15
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	+	5.0
<i>Fimbristylis simulans</i>	+	0.17
<i>Gompholobium polyzygum</i>	extern	0.4
<i>Gomphrena kanisii</i>	+	0.35
<i>Goodenia stobbsiana</i>		

<i>Goodenia triodiophila</i>	+	0.2
<i>Grevillea wickhamii</i>	+	
<i>Hakea lorea</i>	+	2.2
<i>Heliotropium chrysocarpum</i>	+	0.25
<i>Indigofera monophylla</i>	+	0.15
<i>Paraneurachne muelleri</i>	+	0.4
<i>Phyllanthus maderaspatensis</i>	+	0.05
<i>Polycarpaea corymbosa</i>	+	0.15
<i>Polycarpaea holtzei</i>	+	0.03
<i>Polycarpaea longiflora</i>	+	0.25
<i>Portulaca oleracea</i>	+	prostrate
<i>Ptilotus calostachyus</i>	+	1.1
<i>Ptilotus exaltatus</i>	+	0.25
<i>Ptilotus polystachyus</i>	+	0.25
<i>Schizachyrium fragile</i>	+	0.12
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	+	0.3
<i>Senna ferraria</i>	+	1.7
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	0.4
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	+	0.4
<i>Sida arenicola</i>	+	0.6
<i>Sida</i> sp. Pilbara (A.A Mitchell PRP 1543)	+	
<i>Solanum phlomoides</i>	+	0.17
<i>Sporobolus australasicus</i>	+	0.08
<i>Tephrosia</i> sp. Cathedral Gorge (F.H. Mollemans 2420)	+	0.08
<i>Tephrosia supina</i>	+	0.17
<i>Trianthema glossostigma</i>	+	prostrate
<i>Trianthema pilosa</i>	+	prostrate
<i>Triodia</i> sp. Shovelanna Hill (S. van Leeuwen 3835)	10	0.2
<i>Triodia wiseana</i>	10	0.2

URS/IOH Iron Valley

Site

IOH22

Location: South of circular heritage area
m**Type:** Q

50 x 50

1st Observation: **Date:** 12/08/2011 **Described by:** WT/NK**Seasonal Conditions:** E**2nd Observation:** **Date:** 30/07/2011 **Described by:** WTTDO**Seasonal Conditions:** E**MGA Zone:** 50**Easting:** 737086 mE**Northing:** 7483390 mN**Habitat:** Mid to lower slope with exposed bedrock**Soil:** Red brown skeletal to shallow sandy loam**Rock Type:** BIF**Vegetation:** *Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over *Triodia lanigera* open hummock grassland.**Vegetation Code:****Vegetation Desc:****Veg Condition:** Excellent**Fire Age:** 2 - 5 yrs**Notes:****Species List**

Name	% Cover	Height
<i>Acacia bivenosa</i>	+	4.0
<i>Acacia inaequilatera</i>	+	2.2
<i>Acacia pachyacra</i>	+	0.7
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	0.12
<i>Corymbia hamersleyana</i>	+	2.5
<i>Dicrastylis cordifolia</i>	+	0.6
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.07
<i>Eriachne pulchella</i>	+	0.1
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	2	5.0
<i>Fimbristylis simulans</i>	+	0.15
<i>Goodenia stobbsiana</i>	+	0.3
<i>Goodenia triodiophila</i>	+	0.35
<i>Grevillea wickhamii</i>	+	0.06
<i>Hakea chordophylla</i>	+	3.5
<i>Oldenlandia crouchiana</i>	+	0.12
<i>Polycarpaea holtzei</i>	+	0.03
<i>Polygala isingii</i>	+	0.03
<i>Ptilotus calostachyus</i>	+	0.4
<i>Ptilotus fusiformis</i>	+	0.35
<i>Schizachyrium fragile</i>	+	0.2
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.5
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	+	1.2
<i>Trianthema glossostigma</i>	+	0.03
<i>Triodia epactia</i>	+	0.45
<i>Triodia lanigera</i>	13	0.45
<i>Triodia wiseana</i>	+	0.2

URS/IOH Iron Valley

Site

IOH23

Location: West of main track south of camp
m**Type:** Q

50 x 50

1st Observation: **Date:** 12/04/2011 **Described by:** NC/CW**Seasonal Conditions:** E**2nd Observation:** **Date:** 30/07/2011 **Described by:** WTTDO**Seasonal Conditions:** E**MGA Zone:** 50**Easting:** 737732 mE**Northing:** 7483784 mN**Habitat:** Open flat vegetated plain with hills to east and west**Soil:** Red brown sandy loam**Rock Type:****Vegetation:** *Petalostylis labicheoides* scattered shrubs over *Sida* sp. Pilbara scattered shrubs over *Bonamia erecta* low open shrubland over *Triodia lanigera* very open hummock grassland.**Vegetation Code:****Vegetation Desc:****Veg Condition:** Excellent**Fire Age:** 2 - 5 yrs**Notes:****Species List**

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.4
<i>Acacia ancistrocarpa</i>	+	0.7
<i>Acacia pachyacra</i>	+	0.5
<i>Acacia pyrifolia</i>	+	0.9
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.5
<i>Bonamia erecta</i>	2	0.4
<i>Chrysopogon fallax</i>	+	1.4
<i>Cleome viscosa</i>	+	0.6
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	0.15
<i>Corchorus tectus</i>	+	0.5
<i>Dicrastylis cordifolia</i>	+	0.6
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.05
<i>Eragrostis cumingii</i>	+	0.1
<i>Eragrostis eriopoda</i>	+	0.5
<i>Eriachne aristidea</i>	+	0.35
<i>Euphorbia australis</i>	+	0.08
<i>Fimbristylis simulans</i>	+	0.15
<i>Gomphrena cunninghamii</i>	+	0.1
<i>Goodenia microptera</i>	+	0.05
<i>Grevillea wickhamii</i>	+	1.2
<i>Haloragis gossei</i>	+	0.25
<i>Heliotropium chrysocarpum</i>	+	0.25
<i>Hibiscus sturtii</i> var. <i>platychlamys</i>	+	0.35
<i>Hybanthus aurantiacus</i>	+	0.2

<i>Indigofera monophylla</i>	+	0.4
<i>Paraneurachne muelleri</i>	+	0.4
<i>Petalostylis labicheoides</i>	1	1.2
<i>Phyllanthus maderaspatensis</i>	+	0.1
<i>Polycarpaea corymbosa</i>	+	0.12
<i>Polycarpaea holtzei</i>	+	0.05
<i>Portulaca oleracea</i>	+	0.03
<i>Ptilotus astrolasius</i>	+	0.1
<i>Ptilotus exaltatus</i>	+	0.8
<i>Ptilotus polystachyus</i>	+	0.75
<i>Scaevola parvifolia</i> subsp. <i>pilbarae</i>	+	0.2
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	+	1.0
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.8
<i>Senna curvistyla</i>	+	0.1
<i>Senna notabilis</i>	+	0.3
<i>Sida</i> sp. Pilbara (A.A Mitchell PRP 1543)	1	1.2
<i>Solanum sturtianum</i>	+	0.8
<i>Trianthema glossostigma</i>	+	0.04
<i>Trianthema pilosa</i>	+	0.15
<i>Tribulopsis angustifolia</i>	+	prostrate
<i>Tribulus macrocarpus</i>	+	prostrate
<i>Triodia lanigera</i>	5	0.4
<i>Velleia connata</i>	+	0.08
<i>Yakirra australiensis</i> var. <i>australiensis</i>	+	0.1

URS/IOH Iron Valley

Site

IOH24

Location:

m

Type: Q

50 x 50

1st Observation: Date: 13/04/2011 Described by: WT/NK

Seasonal Conditions: E

2nd Observation: Date: 29/07/2011 Described by: WTTDO

Seasonal Conditions: E

MGA Zone: 50

Easting: 737235 mE

Northing: 7483166 mN

Habitat: Lower slope/pediments

Soil: Red brown shallow/deep colluvial flat/sandy loam

Rock Type: Ironstone gravel

Vegetation: *Eucalyptus gamophylla* scattered low trees over *Triodia lanigera*, *T. epactia* very open hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Good

Fire Age: No fire evident

Notes: Lots of dead stumps and shrubs, possibly grazed.

Species List

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.55
<i>Acacia ancistrocarpa</i>	+	2.2
<i>Acacia bivenosa</i>	+	2.5
<i>Acacia citrinoviridis</i>	+	1.4
<i>Acacia inaequilatera</i>	+	2.5
<i>Acacia pachyacra</i>	+	2.2
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.4
<i>Atalaya hemiglauca</i>	+	2.5
<i>Boerhavia coccinea</i>	+	0.06
<i>Bulbostylis barbata</i>	+	0.08
<i>Cenchrus ciliaris</i>	+	0.4
<i>Cleome viscosa</i>	+	0.3
<i>Corchorus tectus</i>	+	0.3
<i>Cucumis maderaspatanus</i>	+	0.12
<i>Cymbopogon oblectus</i>	+	0.7
<i>Duperreya commixta</i>	+	1.0
<i>Dysphania kalpari</i>	+	0.06
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.08
<i>Enneapogon polyphyllus</i>	+	0.5
<i>Eragrostis eriopoda</i>	+	0.4
<i>Eremophila longifolia</i>	+	2.0
<i>Eriachne mucronata</i>	+	0.25
<i>Eucalyptus gamophylla</i>	1	4.0
<i>Euphorbia australis</i>	+	0.15

<i>Fimbristylis simulans</i>	+	0.12
<i>Gomphrena cunninghamii</i>	+	0.15
<i>Goodenia microptera</i>	+	0.25
<i>Hakea chordophylla</i>	+	4.0
<i>Haloragis gossei</i>	+	0.12
<i>Heliotropium chrysocarpum</i>	+	0.1
<i>Heliotropium cunninghamii</i>	+	0.12
<i>Hibiscus leptocladus</i>	extern	0.3
<i>Hibiscus sturtii</i> var. <i>platychlamys</i>	+	0.6
<i>Hybanthus aurantiacus</i>	+	0.4
<i>Indigofera monophylla</i>	+	0.35
<i>Mirbelia viminalis</i>	+	.5
<i>Mollugo molluginea</i>	+	0.08
<i>Paraneurachne muelleri</i>	+	0.2
<i>Perotis rara</i>	+	0.1
<i>Petalostylis labicheoides</i>	+	1.3
<i>Polycarpaea corymbosa</i>	+	0.15
<i>Polycarpaea holtzei</i>	+	0.04
<i>Polycarpaea longiflora</i>	+	0.2
<i>Portulaca oleracea</i>	+	0.04
<i>Pterocaulon sphaeranthoides</i>	+	0.1
<i>Ptilotus calostachyus</i>	+	0.75
<i>Ptilotus exaltatus</i>	+	0.6
<i>Ptilotus obovatus</i>	+	0.3
<i>Ptilotus polystachyus</i>	+	0.5
<i>Salsola tragus</i>	+	0.25
<i>Santalum lanceolatum</i>	+	2.5
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	+	0.75
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.8
<i>Senna glutinosa</i> subsp. x <i>luerssenii</i>	+	1.0
<i>Senna notabilis</i>	+	0.25
<i>Sida cardiophylla</i>	+	0.65
<i>Sida</i> sp. verrucose glands (F.H. Mollemans 2423)	+	0.3
<i>Solanum lasiophyllum</i>	+	0.5
<i>Sporobolus australasicus</i>	+	0.1
<i>Trianthema pilosa</i>	+	0.06
<i>Tribulopsis angustifolia</i>	+	0.03
<i>Tribulus macrocarpus</i>	+	0.05
<i>Trichodesma zeylanicum</i>	+	0.1
<i>Triodia epactia</i>	2	0.7
<i>Triodia lanigera</i>	3	0.4
<i>Yakirra australiensis</i> var. <i>australiensis</i>	+	0.08

URS/IOH Iron Valley

Site

IOH25

Location: West of main track up Lookout Hill, west of 1st m**Type:** Q

50 x 50

aboriginal heritage area

1st Observation: **Date:** 13/04/2011 **Described by:** NC/CW**Seasonal Conditions:** E**2nd Observation:** **Date:** 31/07/2011 **Described by:** WTTDO**Seasonal Conditions:** E**MGA Zone:** 50**Easting:** 737286 mE**Northing:** 7484833 mN**Habitat:** Upper slope of northeast facing tall hill**Soil:** Orange brown sandy loam**Rock Type:** Ironstone rocks, shales and exposed bedrock**Vegetation:** *Acacia hilliana* and *A. spondylophylla* low open shrubland over *Triodia* sp. Shovelanna Hill hummock grassland.**Vegetation Code:****Vegetation Desc:****Veg Condition:** Excellent**Fire Age:** 5 - 10 yrs**Notes:** *Pseudomys chapmani* (Pebble-Mound Mouse) mound in quadrat, possibly active.

Species List

Name	% Cover	Height
<i>Acacia hilliana</i>	1	0.5
<i>Acacia maitlandii</i>	+	1.3
<i>Acacia monticola</i>	+	2.1
<i>Acacia spondylophylla</i>	1	0.6
<i>Acacia tumida</i> var. <i>pilbarensis</i>	+	0.1
<i>Amyema gibberula</i> var. <i>gibberula</i>	+	0.2
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	0.1
<i>Eriachne lanata</i>	+	0.5
<i>Eriachne pulchella</i>	+	0.1
<i>Eucalyptus gamophylla</i>	+	2.5
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	+	5.0
<i>Fimbristylis simulans</i>	+	0.15
<i>Goodenia stobbsiana</i>	+	0.1
<i>Grevillea wickhamii</i>	+	2.5
<i>Hakea lorea</i>	+	2.6
<i>Haloragis gossei</i>	+	0.2
<i>Hybanthus aurantiacus</i>	+	0.3
<i>Petalostylis labicheoides</i>	+	2.5
<i>Polycarpaea holtzei</i>	+	0.03
<i>Ptilotus astrolasius</i>	+	0.18
<i>Ptilotus calostachyus</i>	+	0.45
<i>Schizachyrium fragile</i>	+	0.55
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.45
<i>Senna glutinosa</i> subsp. x <i>luerssenii</i>	+	1.6
<i>Senna notabilis</i>	+	0.15
<i>Trianthema glossostigma</i>	+	0.02
<i>Triodia epactia</i>	+	0.45
<i>Triodia</i> sp. Shovelanna Hill (S. van Leeuwen 3835)	40	0.3

URS/IOH Iron Valley

Site

IOH26

Location:
m

Type: Q

50 x 50

1st Observation: Date: 12/08/2011 Described by: WT/NK Seasonal Conditions: E

2nd Observation: Date: 30/07/2011 Described by: WTTDO Seasonal Conditions: E

MGA Zone: 50 Easting: 737510 mE Northing: 7483245 mN

Habitat: Upper slope of outcrop, bed rock exposed on eastern side

Soil: Red brown shallow loamy sand

Rock Type: Weathered ironstone, not laminar

Vegetation: *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Acacia hilliana* low open shrubland over *Triodia lanigera*, *T. wiseana*, *T. epactia* very open hummock grassland

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 0 - 2 yrs

Notes:

Species List

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.3
<i>Acacia ancistrocarpa</i>	+	0.45
<i>Acacia bivenosa</i>	+	2.0
<i>Acacia citrinoviridis</i>	+	0.4
<i>Acacia hilliana</i>	2	0.4
<i>Acacia inaequilatera</i>	+	2.5
<i>Acacia pachyacra</i>	+	0.35
<i>Acacia pruinocarpa</i>	+	0.45
<i>Aristida contorta</i>	+	0.25
<i>Bonamia media</i> var. <i>villosa</i>	+	0.05
<i>Calytrix carinata</i>	+	0.3
<i>Cleome viscosa</i>	+	0.4
<i>Corchorus lasiocarpus</i> subsp. <i>lasiocarpus</i>	+	0.4
<i>Dampiera candidans</i>	+	0.25
<i>Dicrastylis cordifolia</i>	+	0.4
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.05
<i>Enchylaena tomentosa</i>	+	0.2
<i>Eragrostis eriopoda</i>	+	0.3
<i>Eriachne aristidea</i>	+	0.25
<i>Eriachne mucronata</i>	+	0.2
<i>Eriachne pulchella</i>	+	0.15
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	1	4.5
<i>Fimbristylis simulans</i>	+	0.12
<i>Gomphrena affinis</i> subsp. <i>pilbarensis</i>	+	0.12
<i>Goodenia muelleriana</i>	+	0.25
<i>Goodenia stobbsiana</i>	+	0.25

<i>Goodenia triodiophila</i>	+	0.25
<i>Grevillea wickhamii</i>	+	2.0
<i>Hakea lorea</i>	+	3.0
<i>Heliotropium chrysocarpum</i>	+	0.18
<i>Heliotropium cunninghamii</i>	+	0.18
<i>Hibiscus sturtii</i> var. <i>campylochlamys</i>	+	0.22
<i>Indigofera monophylla</i>	+	0.3
<i>Paraneurachne muelleri</i>	+	0.5
<i>Polycarpaea corymbosa</i>	+	0.1
<i>Polycarpaea holtzei</i>	+	0.03
<i>Ptilotus auriculifolius</i>	+	0.25
<i>Ptilotus calostachyus</i>	+	0.6
<i>Ptilotus exaltatus</i>	+	0.65
<i>Ptilotus obovatus</i>	+	0.3
<i>Schizachyrium fragile</i>	+	0.4
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.6
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	1.3
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	+	1.0
<i>Sida arenicola</i>	+	0.3
<i>Sida cardiophylla</i>	+	0.25
<i>Sida</i> sp. Pilbara (A.A Mitchell PRP 1543)	+	0.35
<i>Trianthema glossostigma</i>	+	0.03
<i>Triodia lanigera</i>	3	0.25
<i>Triodia</i> sp (<i>epactia/pungens</i>)	1	0.5
<i>Triodia wiseana</i>	3	0.3

URS/IOH Iron Valley

Site

IOH27

Location: West of main track, up lookout hill, west of first m**Type:** Q

50 x 50

aboriginal heritage area

1st Observation: **Date:** 13/04/2011 **Described by:** NC/CW**Seasonal Conditions:** E**2nd Observation:** **Date:** 31/07/2011 **Described by:** WTTDO**Seasonal Conditions:** E**MGA Zone:** 50**Easting:** 737026 mE**Northing:** 7484883 mN**Habitat:** Crest of northeast facing tall hill**Soil:** Orange brown sandy loam**Rock Type:** Ironstone rock, shales of exposed bedrock**Vegetation:** *Grevillea wickhamii* and *Hakea lorea* scattered tall shrubs over *Acacia maitlandii* scattered low shrubs over *Triodia* sp. Shovelanna Hill hummock grassland.**Vegetation Code:****Vegetation Desc:****Veg Condition:** Excellent**Fire Age:** 5 - 10 yrs**Notes:** Olive/brown snake sighted within quadrat

Species List

Name	% Cover	Height
<i>Acacia hilliana</i>	+	0.3
<i>Acacia maitlandii</i>	+	3.0
<i>Acacia spondylophylla</i>	+	0.9
<i>Acacia synchronicia</i>	extern	2.0
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.5
<i>Calytrix carinata</i>	+	0.4
<i>Cleome viscosa</i>	+	0.4
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	0.25
<i>Eriachne mucronata</i>	+	0.45
<i>Eriachne pulchella</i>	+	0.1
<i>Fimbristylis simulans</i>	+	0.2
<i>Goodenia stobbsiana</i>	+	0.15
<i>Grevillea wickhamii</i>	+	3.0
<i>Hakea lorea</i>	+	3.5
<i>Petalostylis labicheoides</i>	+	2.5
<i>Phyllanthus maderaspatensis</i>	+	0.03
<i>Polycarpaea holtzei</i>	+	0.05
<i>Ptilotus calostachyus</i>	+	0.5
<i>Schizachyrium fragile</i>	+	0.5
<i>Trianthema glossostigma</i>	+	prostrate
<i>Triodia</i> sp. Shovelanna Hill (S. van Leeuwen 3835)	35	0.4
<i>Yakirra australiensis</i> var. <i>australiensis</i>	+	0.15

URS/IOH Iron Valley

Site

IOH28

Location: East side of ridge
m

Type: Q

50 x 50

1st Observation: Date: 12/08/2011 Described by: WT/NK

Seasonal Conditions: E

2nd Observation: Date: 30/07/2011 Described by: WTTDO

Seasonal Conditions: E

MGA Zone: 50

Easting: 737710 mE

Northing: 7483130 mN

Habitat: Flat outwash plain on east side of rock outcrop

Soil: Red brown shallow sandy loam

Rock Type: Mixed metamorphic sediments and weathered ironstone

Vegetation: *Petalostylis cassioides* and *Sida cardiophylla* open shrubland over *Triodia lanigera* open hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 2 - 5 yrs

Notes:

Species List

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	extern	0.45
<i>Acacia citrinoviridis</i>	+	1.0
<i>Acacia inaequilatera</i>	+	1.5
<i>Acacia pruinocarpa</i>	+	1.0
<i>Acacia tumida</i>	+	0.55
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.6
<i>Bonamia erecta</i>	+	0.4
<i>Cleome viscosa</i>	+	0.5
<i>Corchorus tectus</i>	+	0.5
<i>Corymbia hamersleyana</i>	+	1.3
<i>Dicrastylis cordifolia</i>	+	0.6
<i>Dodonaea coriacea</i>	+	0.75
<i>Dysphania kalpari</i>	+	0.06
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.1
<i>Eragrostis eriopoda</i>	+	0.6
<i>Eriachne mucronata</i>	+	0.25
<i>Eucalyptus gamophylla</i>	+	2.5
<i>Euphorbia australis</i>	+	0.1
<i>Euphorbia biconvexa</i>	+	0.25
<i>Gomphrena affinis</i> subsp. <i>pilbarensis</i>	+	0.25
<i>Goodenia triodiophila</i>	+	0.2
<i>Grevillea wickhamii</i>	+	0.8
<i>Hakea lorea</i>	+	0.5
<i>Heliotropium cunninghamii</i>	+	0.18

<i>Indigofera georgei</i>	+	0.07
<i>Indigofera monophylla</i>	+	0.35
<i>Keraudrenia velutina</i> subsp. <i>elliptica</i>	+	0.45
<i>Paraneurachne muelleri</i>	+	0.5
<i>Petalostylis labicheoides</i>	1	1.5
<i>Ptilotus auriculifolius</i>	+	0.3
<i>Ptilotus exaltatus</i>	+	0.6
<i>Ptilotus obovatus</i>	+	0.5
<i>Santalum lanceolatum</i>	+	1.8
<i>Scaevola parvifolia</i> subsp. <i>pilbarae</i>	+	0.2
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	+	0.12
<i>Senna notabilis</i>	+	1.5
<i>Sida cardiophylla</i>	1	1.3
<i>Trianthema pilosa</i>	+	0.05
<i>Tribulus hirsutus</i>	+	0.04
<i>Triodia epactia</i>	+	0.6
<i>Triodia lanigera</i>	22	0.6

URS/IOH Iron Valley

Site

IOH29r

Location: Minor creekline west of aboriginal heritage area**Type:** R**1st Observation:** **Date:** 12/08/2011 **Described by:** NC/CW**Seasonal Conditions:** E**2nd Observation:** **Date:** 30/07/2011 **Described by:** WTTDO**Seasonal Conditions:** E**MGA Zone:** 50**Easting:** 737163 mE**Northing:** 7484256 mN**Habitat:** Minor creekline between tall hills, flows approximately east - west**Soil:** Brown sand covered in thick layer of iron stone shales**Rock Type:** Ironstone scree/shales**Vegetation:** *Acacia tumida* low open forest over *Triodia epactia* very open hummock grassland.**Vegetation Code:****Vegetation Desc:****Veg Condition:** Excellent**Fire Age:** 5 - 10 years**Notes:**

Species List

Name	% Cover	Height
<i>Abutilon dioicum</i>	+	0.9
<i>Acacia pyrifolia</i>	+	2.0
<i>Acacia tumida</i>	65	3.5
<i>Amaranthus undulatus</i>	+	0.3
<i>Atalaya hemiglauc</i>	+	1.5
<i>Boerhavia coccinea</i>	+	0.1
<i>Cleome viscosa</i>	+	0.5
<i>Clerodendrum floribundum</i> var. <i>floribundum</i>	+	2.0
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	0.4
<i>Corchorus tridens</i>	+	0.05
<i>Crotalaria medicaginea</i> var. <i>neglecta</i>	+	0.4
<i>Cymbopogon oblectus</i>	+	0.6
<i>Duperreya commixta</i>	+	2.0
<i>Enneapogon lindleyanus</i>	+	0.5
<i>Eriachne mucronata</i>	+	0.6
<i>Euphorbia biconvexa</i>	+	0.35
<i>Fimbristylis simulans</i>	+	0.1
<i>Gomphrena cunninghamii</i>	+	0.08
<i>Gossypium robinsonii</i>	+	2.2
<i>Grevillea wickhamii</i>	+	1.7
<i>Hybanthus aurantiacus</i>	+	0.25
<i>Indigofera monophylla</i>	+	0.5
<i>Ipomoea polymorpha</i>	+	prostrate
<i>Jasminum didymum</i> subsp. <i>lineare</i>	+	climber
<i>Paraneurachne muelleri</i>	+	0.5
<i>Perotis rara</i>	+	0.1
<i>Petalostylis labicheoides</i>	+	2.1

<i>Phyllanthus maderaspatensis</i>	+	0.1
<i>Polycarpaea longiflora</i>	+	0.15
<i>Ptilotus fusiformis</i>	+	0.4
<i>Rhynchosia minima</i>	+	climber
<i>Schizachyrium fragile</i>	+	0.4
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.4
<i>Senna notabilis</i>	+	0.15
<i>Sida</i> sp. Articulation below (A.A. Mitchell PRP 1605)	+	0.4
<i>Stylobasium spathulatum</i>	+	2.2
<i>Tephrosia densa</i>	+	0.65
<i>Tephrosia rosea</i> var. <i>glabrior</i>	+	0.4
<i>Themeda triandra</i>	+	0.7
<i>Trachymene oleracea</i>	+	0.4
<i>Trichodesma zeylanicum</i>	+	0.4
<i>Triodia epactia</i>	5	0.45

URS/IOH Iron Valley

Site

IOH30

Location: Proposed infrastructure site
m**Type:** Q

50 x 50

1st Observation: **Date:** 12/08/2011 **Described by:** WT/NK**Seasonal Conditions:** E**2nd Observation:** **Date:** 28/07/2011 **Described by:** WTTDO**Seasonal Conditions:** E**MGA Zone:** 50**Easting:** 736073 mE**Northing:** 7483454 mN**Habitat:** Upper slope of hill on exposed seam of BIF bedrock**Soil:** Red brown skeletal sandy loam**Rock Type:** BIF**Vegetation:** *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Triodia lanigera* open hummock grassland.**Vegetation Code:****Vegetation Desc:****Veg Condition:** Excellent**Fire Age:** 2 - 5 yrs**Notes:****Species List**

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.35
<i>Acacia bivenosa</i>	+	2.2
<i>Acacia dictyophleba</i>	+	0.5
<i>Acacia pyrifolia</i>	+	1.4
<i>Acacia spondylophylla</i>	+	0.4
<i>Amphipogon sericeus</i>	+	0.35
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.35
<i>Bonamia media</i> var. <i>villosa</i>	+	0.05
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	0.4
<i>Cucumis maderaspatanus</i>	+	0.3
<i>Dampiera candidans</i>	+	0.35
<i>Dicrastylis cordifolia</i>	+	0.75
<i>Duperreya commixta</i>	+	climber
<i>Eriachne pulchella</i>	+	0.1
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	1	5.0
<i>Fimbristylis simulans</i>	+	0.12
<i>Goodenia microptera</i>	+	0.2
<i>Goodenia stobbsiana</i>	+	0.2
<i>Goodenia triodiophila</i>	+	0.3
<i>Hakea lorea</i>	+	3.5
<i>Haloragis gossei</i>	+	0.12
<i>Keraudrenia nephrosperma</i>	+	0.45
<i>Polycarpaea holtzei</i>	+	0.03
<i>Ptilotus calostachyus</i>	+	0.55
<i>Ptilotus exaltatus</i>	+	0.55
<i>Schizachyrium fragile</i>	+	0.2
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	+	0.4
<i>Senna ferraria</i>	+	1.2
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	1.2
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	+	1.0
<i>Senna glutinosa</i> subsp. <i>x luerssenii</i>	+	1.0
<i>Sida cardiophylla</i>	+	0.45
<i>Solanum lasiophyllum</i>	+	0.4
<i>Tribulus suberosus</i>	+	0.6
<i>Triodia lanigera</i>	10	0.3

URS/IOH Iron Valley

Site

IOH31

Location: Western edge of survey area
m**Type:** Q

50 x 50

1st Observation: **Date:** 13/04/2011 **Described by:** NC/CW**Seasonal Conditions:** E**2nd Observation:** **Date:** 31/07/2011 **Described by:** WTTDO**Seasonal Conditions:** E**MGA Zone:** 50**Easting:** 736922 mE**Northing:** 7484698 mN**Habitat:** Crest and upper western slope of very high hill**Soil:** Red brown sandy loam**Rock Type:** Ironstone shales and exposed bedrock**Vegetation:** *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Triodia* sp. Shovelanna Hill and *T. wiseana* hummock grassland.**Vegetation Code:****Vegetation Desc:****Veg Condition:** Excellent**Fire Age:** 5 - 10 yrs**Notes:****Species List**

Name	% Cover	Height
<i>Acacia hamersleyensis</i>	+	2.5
<i>Acacia hilliana</i>	+	0.5
<i>Acacia monticola</i>	+	1.6
<i>Acacia pruinocarpa</i>	+	1.5
<i>Acacia pyrifolia</i>	+	1.8
<i>Acacia spondylophylla</i>	+	0.9
<i>Acacia tumida</i>	+	2.5
<i>Bulbostylis barbata</i>	+	
<i>Cleome viscosa</i>	+	0.4
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	0.1
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	
<i>Eriachne lanata</i>	+	0.6
<i>Eriachne mucronata</i>	+	0.3
<i>Eriachne pulchella</i>	+	0.2
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	1	4.5
<i>Fimbristylis simulans</i>	+	0.2
<i>Gomphrena cunninghamii</i>	+	0.15
<i>Goodenia triodiophila</i>	+	0.1
<i>Gossypium robinsonii</i>	+	0.1
<i>Grevillea wickhamii</i>	+	3.0
<i>Hakea lorea</i>	+	3.5
<i>Petalostylis labicheoides</i>	+	1.2
<i>Polycarpaea holtzei</i>	+	0.04
<i>Polycarpaea longiflora</i>	+	0.15
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	2.0
<i>Triodia</i> sp. Shovelanna Hill (S. van Leeuwen 3835)	30	0.5
<i>Triodia wiseana</i>	25	0.5

URS/IOH Iron Valley

Site IOH32

Location: Proposed infrastructure area in northwest of survey area
Type: Q 50 x 50 m

1st Observation: **Date:** 14/04/2011 **Described by:** WT/NK **Seasonal Conditions:** E

2nd Observation: **Date:** 28/07/2011 **Described by:** WTTDO **Seasonal Conditions:** E

MGA Zone: 50 **Easting:** 735963 mE **Northing:** 7483547 mN

Habitat: Mid hillslope on large exposed bedrock seam

Soil: Red brown skeletal loamy sand

Rock Type: Weathered ironstone/BIF

Vegetation: *Grevillea wickhamii* scattered tall shrubs over *Triodia basedowii* very open hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 0 - 2 years

Notes:

Species List

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.2
<i>Acacia inaequilatera</i>	+	1.3
<i>Acacia pyrifolia</i>	+	0.45
<i>Amphipogon sericeus</i>	+	0.22
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.35
<i>Bonamia media</i> var. <i>villosa</i>	+	0.06
<i>Bulbostylis barbata</i>	+	0.2
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	0.5
<i>Dampiera candidans</i>	+	0.6
<i>Dicrastylis cordifolia</i>	+	0.55
<i>Dysphania kalpari</i>	+	0.06
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.18
<i>Eriachne aristidea</i>	+	0.3
<i>Eriachne mucronata</i>	+	0.25
<i>Eriachne pulchella</i>	+	0.25
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	+	0.05
<i>Fimbristylis simulans</i>	+	0.5
<i>Gomphrena cunninghamii</i>	+	0.14
<i>Goodenia stobbsiana</i>	+	0.2
<i>Goodenia triodiophila</i>	+	0.2
<i>Grevillea wickhamii</i>	1	3.0
<i>Hakea lorea</i>	+	0.35
<i>Paraneurachne muelleri</i>	+	0.55
<i>Polycarpaea holtzei</i>	+	0.04
<i>Polygala isingii</i>	+	0.03
<i>Ptilotus aervoides</i>	+	0.06
<i>Ptilotus astrolasius</i>	+	0.2
<i>Ptilotus auriculifolius</i>	+	0.22
<i>Ptilotus calostachyus</i>	+	1.2
<i>Ptilotus clementii</i>	+	
<i>Ptilotus exaltatus</i>	+	0.35
<i>Ptilotus fusiformis</i>	+	0.2
<i>Ptilotus polystachyus</i>	+	0.3
<i>Schizachyrium fragile</i>	+	0.25

<i>Senna ferraria</i>	+	0.8
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	1.0
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	+	0.1
<i>Senna glutinosa</i> subsp. x <i>luerssenii</i>	+	0.75
<i>Sida cardiophylla</i>	+	0.5
<i>Solanum horridum</i>	+	0.1
<i>Solanum phlomoides</i>	+	0.35
<i>Sporobolus australasicus</i>	+	0.1
<i>Tephrosia</i> sp. Cathedral Gorge (F.H. Mollemans 2420)	+	0.04
<i>Tribulus hirsutus</i>	+	0.08
<i>Triodia basedowii</i>	2	0.25
<i>Triodia epactia</i>	+	0.3

URS/IOH Iron Valley

Site

IOH33

Location: Creek/fluvial outflow southwest of camp and west
m
of track

Type: Q

50 x 50

1st Observation: **Date:** 14/04/2011 **Described by:** NC/CW **Seasonal Conditions:** E

2nd Observation: **Date:** 28/07/2011 **Described by:** WTTDO **Seasonal Conditions:** E

MGA Zone: 50 **Easting:** 736258 mE **Northing:** 7482573 mN

Habitat: Vegetated floodplain between and creek and high hills to the north

Soil: Red brown sandy clay

Rock Type: Ironstone shales

Vegetation: *Acacia pyrifolia* scattered shrubs over **Cenchrus ciliaris* closed tussock grassland with *Triodia epactia* scattered hummock grasses.

Vegetation Code:

Vegetation Desc:

Veg Condition: Poor/partially degraded

Fire Age: > 10 yrs

Notes:

Species List

Name	% Cover	Height
<i>Acacia arida</i>	+	2.0
<i>Acacia pyrifolia</i>	1	1.7
<i>Acacia tumida</i>	+	2.5
<i>Amaranthus undulatus</i>	+	0.2
<i>Atalaya hemiglauc</i>	+	1.5
<i>Boerhavia coccinea</i>	+	prostrate
<i>Cenchrus ciliaris</i>	80	1.0
<i>Cenchrus setiger</i>	30	1.0
<i>Cleome viscosa</i>	+	0.6
<i>Corchorus crozophorifolius</i>	+	1.2
<i>Corchorus tridens</i>	+	0.1
<i>Cucumis maderaspatanus</i>	+	climber
<i>Dysphania kalpari</i>	+	0.05
<i>Eragrostis cumingii</i>	+	0.2
<i>Eremophila longifolia</i>	+	1.2
<i>Eriachne mucronata</i>	+	0.35
<i>Eriachne pulchella</i>	+	0.1
<i>Eucalyptus victrix</i>	+	8.5
<i>Euphorbia biconvexa</i>	+	0.5
<i>Euphorbia tannensis</i> subsp. <i>eremophila</i>	+	0.25
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	+	0.15
<i>Gomphrena cunninghamii</i>	+	0.25
<i>Gossypium robinsonii</i>	+	2.5
<i>Grevillea wickhamii</i>	+	3.0
<i>Hybanthus aurantiacus</i>	+	0.3

<i>Indigofera georgei</i>	+	0.2
<i>Ipomoea polymorpha</i>	+	prostrate
<i>Mollugo molluginea</i>	+	0.1
<i>Notoleptopus decaisnei</i>	+	0.6
<i>Perotis rara</i>	+	0.15
<i>Polycarpaea corymbosa</i>	+	0.25
<i>Polycarpaea longiflora</i>	+	0.35
<i>Pterocaulon sphaeranthoides</i>	+	0.1
<i>Ptilotus exaltatus</i>	+	0.05
<i>Ptilotus obovatus</i>	+	0.1
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	+	1.0
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	+	0.9
<i>Senna notabilis</i>	+	0.15
<i>Solanum lasiophyllum</i>	+	0.6
<i>Solanum phlomoides</i>	+	0.5
<i>Tephrosia densa</i>	+	0.45
<i>Tephrosia rosea</i>	+	0.3
<i>Trichodesma zeylanicum</i>	+	0.3
<i>Triodia epactia</i>	2	0.45

URS/IOH Iron Valley

Site

IOH34

Location: Proposed infrastructure area within tenement. **Type:** Q 50 x 50 m

1st Observation: **Date:** 16/08/2011 **Described by:** WT/NK **Seasonal Conditions:** E

2nd Observation: **Date:** 28/07/2011 **Described by:** WTTDO **Seasonal Conditions:** E

MGA Zone: 50 **Easting:** 736235 mE **Northing:** 7483029 mN

Habitat: Midslope

Soil: Red brown shallow and skeletal loamy sand

Rock Type: Weathered ironstone

Vegetation: *Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over *Triodia basedowii* very open hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 2 - 5 yrs

Notes:

Species List

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.45
<i>Acacia hilliana</i>	+	0.45
<i>Acacia pruinocarpa</i>	+	1.2
<i>Amphipogon sericeus</i>	+	0.3
<i>Amyema miquelii</i>	+	2.0
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.22
<i>Cassutha capillaris</i>	+	0.05
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	0.3
<i>Cucumis maderaspatanus</i>	+	0.18
<i>Dodonaea coriacea</i>	+	0.6
<i>Dysphania kalpari</i>	+	0.04
<i>Enneapogon polyphyllus</i>	+	0.3
<i>Eremophila longifolia</i>	+	1.2
<i>Eriachne mucronata</i>	+	0.35
<i>Eriachne pulchella</i>	+	0.1
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	2	7.0
<i>Fimbristylis simulans</i>	+	0.18
<i>Goodenia stobbsiana</i>	+	0.2
<i>Goodenia triodiophila</i>	+	0.22
<i>Hakea lorea</i>	+	4.0
<i>Mirbelia viminalis</i>	+	0.65
<i>Polycarpaea holtzei</i>	+	0.03
<i>Ptilotus calostachyus</i>	+	0.5
<i>Ptilotus exaltatus</i>	+	0.06
<i>Ptilotus obovatus</i>	extern	0.2
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	+	1.0
<i>Senna glutinosa</i> subsp. <i>x luerksenii</i>	+	1.0
<i>Triodia basedowii</i>	8	0.4
<i>Triodia epactia</i>	+	0.35

URS/IOH Iron Valley

Site

IOH35

Location: Creek bed northwest of camp, west of track
25 m**Type:** Q

100 x

1st Observation: **Date:** 16/08/2011 **Described by:** NC/CW**Seasonal Conditions:** E**2nd Observation:** **Date:** 28/07/2011 **Described by:** WTTDO**Seasonal Conditions:** E**MGA Zone:** 50**Easting:** 736641 mE**Northing:** 7482570 mN**Habitat:** Wide shallow creek line**Soil:** Red brown sandy clay**Rock Type:** Ironstone formation, shales and pebbles**Vegetation:** *Acacia tumida* scattered tall shrubs over *Tephrosia rosea* low shrubland over **Cenchrus setiger* scattered tussock grasses.**Vegetation Code:****Vegetation Desc:****Veg Condition:** Excellent**Fire Age:** > 10 yrs**Notes:****Species List**

Name	% Cover	Height
<i>Acacia pyrifolia</i>	+	0.7
<i>Acacia tumida</i>	1	2.5
<i>Amaranthus mitchellii</i>	+	1.0
<i>Amaranthus undulatus</i>	+	0.8
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.4
<i>Boerhavia coccinea</i>	+	0.2
<i>Cenchrus ciliaris</i>	+	0.6
<i>Cenchrus setiger</i>	1	0.5
<i>Cleome viscosa</i>	+	0.6
<i>Corchorus crozophorifolius</i>	+	1.4
<i>Cymbopogon ambiguus</i>	+	1.2
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.3
<i>Enneapogon polyphyllus</i>	+	0.15
<i>Eriachne mucronata</i>	+	0.7
<i>Eriachne pulchella</i>	+	0.1
<i>Euphorbia australis</i>	+	0.15
<i>Fimbristylis simulans</i>	+	0.15
<i>Gomphrena cunninghamii</i>	+	0.1
<i>Goodenia microptera</i>	+	0.35
<i>Gossypium robinsonii</i>	+	1.5
<i>Grevillea wickhamii</i>	+	3.5
<i>Petalostylis labicheoides</i>	+	1.3
<i>Polycarpaea holtzei</i>	+	0.03
<i>Polycarpaea longiflora</i>	+	0.2

<i>Portulaca oleracea</i>	+	0.03
<i>Ptilotus astrolasius</i>	+	0.2
<i>Ptilotus auriculifolius</i>	+	0.3
<i>Ptilotus calostachyus</i>	+	0.55
<i>Ptilotus clementii</i>	+	0.25
<i>Ptilotus exaltatus</i>	+	0.55
<i>Ptilotus fusiformis</i>	+	0.45
<i>Ptilotus polystachyus</i>	+	0.5
<i>Rulingia luteiflora</i>	+	1.8
<i>Salsola tragus</i>	+	0.4
<i>Sida fibulifera</i>	+	0.35
<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)	+	0.35
<i>Tephrosia rosea</i> var. <i>glabrior</i>	15	0.65
<i>Themeda triandra</i>	+	0.6
<i>Trianthema pilosa</i>	+	0.08
<i>Tribulus hirsutus</i>	+	
<i>Tribulus macrocarpus</i>	+	prostrate
<i>Trichodesma zeylanicum</i>	+	0.25
<i>Triodia epactia</i>	+	0.65
<i>Waltheria indica</i>	+	0.4

URS/IOH Iron Valley

Site

IOH36

Location: Footslopes/pediments in infrastructure area
m**Type:** Q

50 x 50

1st Observation: **Date:** 16/08/2011 **Described by:** WT/NK**Seasonal Conditions:** E**2nd Observation:** **Date:** 28/07/2011 **Described by:** WTTDO**Seasonal Conditions:** E**MGA Zone:** 50**Easting:** 736249 mE**Northing:** 7482769 mN**Habitat:** Footslopes/outwash of hillslope**Soil:** Red brown shallow colluvial sandy loam**Rock Type:** BIF, weathered coarse fragments**Vegetation:** *Corymbia opaca* scattered low trees over *Grevillea wickhamii* scattered tall shrubs over *Triodia lanigera*, *Triodia epactia* hummock grassland.**Vegetation Code:****Vegetation Desc:****Veg Condition:** Good**Fire Age:** > 10 yrs**Notes:****Species List**

Name	% Cover	Height
<i>Acacia bivenosa</i>	+	2.5
<i>Acacia dictyophleba</i>	+	3.0
<i>Acacia inaequilatera</i>	+	3.0
<i>Acacia pachyacra</i>	+	
<i>Acacia pyrifolia</i>	+	1.5
<i>Acacia tumida</i>	+	1.2
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.4
<i>Boerhavia coccinea</i>	+	0.08
<i>Bonamia erecta</i>	+	0.3
<i>Cenchrus ciliaris</i>	+	0.6
<i>Cleome viscosa</i>	+	0.25
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	0.25
<i>Corymbia opaca</i>	2	4.0
<i>Cucumis maderaspatanus</i>	+	1.5
<i>Dicrastylis cordifolia</i>	+	0.6
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.1
<i>Eriachne mucronata</i>	+	0.2
<i>Eucalyptus gamophylla</i>	+	3.0
<i>Euphorbia australis</i>	+	0.2
<i>Euphorbia biconvexa</i>	+	0.25
<i>Gomphrena cunninghamii</i>	+	0.07
<i>Goodenia microptera</i>	+	0.1
<i>Goodenia stobbsiana</i>	+	0.15
<i>Gossypium australe</i>	+	0.3
<i>Grevillea wickhamii</i>	1	3.0
<i>Hakea lorea</i>	+	2.8

<i>Hibiscus leptocladus</i>	+	0.12
<i>Hibiscus sturtii</i> var. <i>platychlamys</i>	+	0.4
<i>Hybanthus aurantiacus</i>	+	0.25
<i>Indigofera monophylla</i>	+	0.4
<i>Isotropis atropurpurea</i>	+	0.45
<i>Petalostylis labicheoides</i>	+	1.5
<i>Polycarpaea holtzei</i>	+	0.04
<i>Polycarpaea longiflora</i>	+	0.25
<i>Ptilotus auriculifolius</i>	+	0.4
<i>Ptilotus calostachyus</i>	+	0.45
<i>Ptilotus exaltatus</i>	+	0.08
<i>Ptilotus obovatus</i>	+	0.18
<i>Ptilotus polystachyus</i>	+	0.3
<i>Rhyncharrhena linearis</i>	+	1.0
<i>Santalum lanceolatum</i>	+	1.8
<i>Scaevola spinescens</i>	+	0.35
<i>Schizachyrium fragile</i>	+	0.3
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	+	0.8
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	1.0
<i>Senna notabilis</i>	+	0.2
<i>Sida arenicola</i>	+	0.15
<i>Solanum lasiophyllum</i>	+	0.15
<i>Trianthema pilosa</i>	+	0.06
<i>Tribulus hirsutus</i>	+	0.07
<i>Trichodesma zeylanicum</i>	+	0.22
<i>Triodia epactia</i>	8	0.6
<i>Triodia lanigera</i>	30	0.5
<i>Velleia connata</i>	+	0.3
<i>Yakirra australiensis</i> var. <i>australiensis</i>	+	0.1

URS/IOH Iron Valley

Site

IOH37

Location: Behind ridge east of main track, south of camp m **Type:** Q 50 x 50

1st Observation: **Date:** 16/08/2011 **Described by:** NC/CW **Seasonal Conditions:** E

2nd Observation: **Date:** 29/07/2011 **Described by:** WTTDO **Seasonal Conditions:** E

MGA Zone: 50 **Easting:** 737580 mE **Northing:** 7482739 mN

Habitat: Flat with low hills to west and northwest and creekline to south

Soil: Red brown sandy loam

Rock Type:

Vegetation: *Corymbia hamersleyana* scattered low trees over *Grevillea wickhamii* tall open shrubland over *Triodia epactia* open hummock grassland and **Cenchrus ciliaris* scattered tussock grasses.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 2 -5 years

Notes: Surveyed after good summer rains. Some cow footprints

Species List

Name	% Cover	Height
<i>Abutilon otocarpum</i>	+	0.5
<i>Acacia dictyophleba</i>	+	0.25
<i>Acacia holosericea</i>	+	0.3
<i>Acacia inaequilatera</i>	+	3.5
<i>Acacia pyrifolia</i>	+	1.4
<i>Acacia tumida</i> var. <i>pilbarensis</i>	+	0.8
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.4
<i>Atalaya hemiglauca</i>	+	0.8
<i>Boerhavia coccinea</i>	+	prostrate
<i>Bonamia erecta</i>	+	0.45
<i>Cenchrus ciliaris</i>	1	0.55
<i>Cenchrus setiger</i>	+	0.5
<i>Cleome viscosa</i>	+	0.6
<i>Corchorus tectus</i>	+	0.15
<i>Corchorus tridens</i>	+	prostrate
<i>Corymbia hamersleyana</i>	1	6.0
<i>Cullen lachnostachys</i>	+	0.45
<i>Eragrostis eriopoda</i>	+	0.45
<i>Euphorbia australis</i>	+	0.15
<i>Euphorbia biconvexa</i>	+	0.3
<i>Gomphrena cunninghamii</i>	+	0.25
<i>Gomphrena kanisii</i>	+	0.2
<i>Gossypium robinsonii</i>	+	1.5
<i>Grevillea wickhamii</i>	10	2.5
<i>Hakea lorea</i>	+	1.1
<i>Hibiscus sturtii</i> var. <i>campylochlamys</i>	+	0.3

<i>Hybanthus aurantiacus</i>	+	0.35
<i>Indigofera monophylla</i>	+	0.5
<i>Petalostylis labicheoides</i>	+	1.2
<i>Polycarpaea longiflora</i>	+	0.2
<i>Salsola tragus</i>	+	0.55
<i>Santalum lanceolatum</i>	+	1.0
<i>Scaevola parvifolia</i> subsp. <i>pilbarae</i>	+	0.3
<i>Scaevola spinescens</i>	+	1.0
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	+	0.45
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.9
<i>Senna notabilis</i>	+	0.15
<i>Sida</i> aff. <i>fibulifera</i> (oblong; MET 15 220)	+	0.3
<i>Sida</i> sp. Pilbara (A.A Mitchell PRP 1543)	+	0.5
<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)	+	1.2
<i>Sida</i> sp. verrucose glands (F.H. Mollemans 2423)	+	0.2
<i>Tephrosia densa</i>	+	0.5
<i>Themeda triandra</i>	+	1.2
<i>Tribulopsis angustifolia</i>	+	prostrate
<i>Tribulus macrocarpus</i>	+	prostrate
<i>Triodia basedowii</i>	+	0.4
<i>Triodia epactia</i>	25	0.5

URS/IOH Iron Valley

Site

IOH38

Location: Crest near circular aboriginal heritage area
m**Type:** Q

50 x 50

1st Observation: **Date:** 16/08/2011 **Described by:** WT/CW**Seasonal Conditions:** E**2nd Observation:** **Date:** 29/07/2011 **Described by:** WTTDO**Seasonal Conditions:** E**MGA Zone:** 50 **Easting:** 736462 mE**Northing:** 7483703 mN**Habitat:** Crest of hill/ridge**Soil:** Red brown skeletal sandy loam**Rock Type:** Weathered ironstone, some BIF**Vegetation:** *Triodia basedowii* very open hummock grassland.**Vegetation Code:****Vegetation Desc:****Veg Condition:** Excellent**Fire Age:** 0 - 2 yrs**Notes:****Species List**

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.4
<i>Acacia pruinocarpa</i>	+	2.2
<i>Corymbia deserticola</i>	+	2.0
<i>Fimbristylis simulans</i>	+	0.15
<i>Goodenia stobbsiana</i>	+	0.35
<i>Hakea lorea</i>	+	0.45
<i>Polygala isingii</i>	+	0.03
<i>Ptilotus calostachyus</i>	+	0.45
<i>Ptilotus exaltatus</i>	+	0.08
<i>Schizachyrium fragile</i>	+	0.2
<i>Trianthema glossostigma</i>	+	0.03
<i>Triodia basedowii</i>	8	0.25
<i>Triodia epactia</i>	+	0.45
<i>Triodia wiseana</i>	+	0.35

URS/IOH Iron Valley

Site

IOH39r

Location: East of main track, south of camp**Type:** R**1st Observation:** **Date:** 16/08/2011 **Described by:** NC**Seasonal Conditions:** E**2nd Observation:** **Date:** 29/07/2011 **Described by:** WTTDO**Seasonal Conditions:** E**MGA Zone:** 50 **Easting:** 737575 mE**Northing:** 7482655 mN**Habitat:** Wide shallow creekline flowing east to west**Soil:** Red brown sandy clay**Rock Type:** Ironstone shales and rocks**Vegetation:** Tephrosia rosea low shrubland.**Vegetation Code:****Vegetation Desc:****Veg Condition:** Excellent**Fire Age:** 2 - 5 yrs**Notes:** Surveyed after good summer rain

Species List

Name	% Cover	Height
<i>Acacia pyrifolia</i>	+	1.6
<i>Acacia tumida</i>	+	1.5
<i>Acacia tumida</i> var. <i>pilbarensis</i>	+	0.9
<i>Amaranthus mitchellii</i>	+	
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.3
<i>Boerhavia coccinea</i>	+	prostrate
<i>Cenchrus ciliaris</i>	+	0.5
<i>Chrysopogon fallax</i>	+	0.8
<i>Cleome viscosa</i>	+	0.4
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	0.4
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.3
<i>Eriachne mucronata</i>	+	0.5
<i>Eriachne pulchella</i>	+	0.2
<i>Euphorbia australis</i>	+	prostrate
<i>Gomphrena cunninghamii</i>	+	0.15
<i>Grevillea wickhamii</i>	+	1.8
<i>Polycarpaea longiflora</i>	+	0.4
<i>Polymeria ambigua</i>	+	
<i>Ptilotus astrolasius</i>	+	0.3
<i>Ptilotus calostachyus</i>	+	0.6
<i>Ptilotus exaltatus</i>	+	0.3
<i>Sida</i> sp. Pilbara (A.A Mitchell PRP 1543)	+	0.7
<i>Tephrosia rosea</i>	20	0.5
<i>Themeda triandra</i>	+	0.5
<i>Tribulus macrocarpus</i>	+	creeper
<i>Trichodesma zeylanicum</i>	+	2.0
<i>Triodia epactia</i>	+	0.3
<i>Waltheria indica</i>	+	0.5

URS/IOH Iron Valley

Site

IOH40

Location:
m

Type: Q

50 x 50

1st Observation: Date: 16/08/2011 Described by: WT/CW

Seasonal Conditions: E

2nd Observation: Date: 29/07/2011 Described by: WTTDO

Seasonal Conditions: E

MGA Zone: 50

Easting: 736524 mE

Northing: 7483870 mN

Habitat: Midslope - finger slopes of ridge

Soil: Red brown shallow sandy loam

Rock Type: Weathered ironstone and metamorphic rock

Vegetation: *Triodia basedowii* very open hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 0 - 2 years

Notes: Within quadrat a medium sized (1.5 metre) brown/olive coloured snake. Adjacent to quadrat was a possibly active *Pseudomys chapmani* (Pebble-Mound Mouse).

Species List

Name	% Cover	Height
	+	0.4
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.12
<i>Acacia inaequilatera</i>	+	2.0
<i>Acacia pruinocarpa</i>	+	2.0
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.35
<i>Cucumis maderaspatanus</i>	+	0.12
<i>Dicrastylis cordifolia</i>	+	0.3
<i>Eriachne aristidea</i>	+	0.15
<i>Eriachne pulchella</i>	+	0.12
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	+	4.0
<i>Fimbristylis simulans</i>	+	0.18
<i>Goodenia stobbsiana</i>	+	0.2
<i>Grevillea wickhamii</i>	+	2.2
<i>Hakea lorea</i>	+	2.0
<i>Jasminum didymum</i> subsp. <i>lineare</i>	+	0.35
<i>Polycarpaea holtzei</i>	+	0.04
<i>Polycarpaea longiflora</i>	+	0.12
<i>Polygala isingii</i>	+	0.02
<i>Ptilotus astrolasius</i>	+	0.06
<i>Ptilotus calostachyus</i>	+	0.55
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.35
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	1.0
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	+	0.55
<i>Senna glutinosa</i> subsp. x <i>luerssenii</i>	+	0.6
<i>Triodia basedowii</i>	8	0.4
<i>Triodia epactia</i>	+	0.35
<i>Triodia wiseana</i>	+	0.3

URS/IOH Iron Valley

Site

IOH41

Location: South of creekline northwest of camp and west of m **Type:** Q 50 x 50

1st Observation: **Date:** 16/08/2011 **Described by:** NC/CW **Seasonal Conditions:** E

2nd Observation: **Date:** 28/07/2011 **Described by:** WTTDO **Seasonal Conditions:** E

MGA Zone: 50 **Easting:** 737066 mE **Northing:** 7482553 mN

Habitat: Open vegetated flat adjacent to creekline.

Soil: Red brown sandy loam

Rock Type: Ironstone formation, shales and pebbles

Vegetation: *Corymbia opaca* scattered low trees over *Grevillea wickhamii* open shrubland over *Corchorus elachocarpus* herbland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 0 - 2 yrs

Notes:

Species List

Name	% Cover	Height
<i>Abutilon otocarpum</i>	+	0.5
<i>Acacia pyrifolia</i>	+	1.3
<i>Acacia tumida</i> var. <i>pilbarensis</i>	+	0.4
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.4
<i>Atalaya hemiglauca</i>	+	1.0
<i>Boerhavia coccinea</i>	+	prostrate
<i>Bonamia erecta</i>	+	0.35
<i>Cenchrus ciliaris</i>	+	0.5
<i>Cleome viscosa</i>	+	0.7
<i>Corchorus lasiocarpus</i> subsp. <i>lasiocarpus</i>	+	0.75
<i>Corchorus tectus</i>	3	0.4
<i>Corchorus tridens</i>	+	prostrate
<i>Corymbia opaca</i>	+	5.5
<i>Cucumis maderaspatanus</i>	+	.0 -
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.05
<i>Eremophila longifolia</i>	+	0.6
<i>Eriachne mucronata</i>	+	0.65
<i>Euphorbia australis</i>	+	0.1
<i>Goodenia microptera</i>	+	0.2
<i>Gossypium robinsonii</i>	+	1.5
<i>Grevillea wickhamii</i>	5	1.6
<i>Hakea lorea</i>	+	1.4
<i>Hibiscus sturtii</i> var. <i>platychlamys</i>	+	0.25
<i>Hybanthus aurantiacus</i>	+	0.45
<i>Indigofera monophylla</i>	+	0.3

<i>Phyllanthus maderaspatensis</i>	+	0.2
<i>Polycarpaea corymbosa</i>	+	0.1
<i>Portulaca oleracea</i>	+	prostrate
<i>Pterocaulon sphaeranthoides</i>	+	0.04
<i>Ptilotus astrolasius</i>	+	0.6
<i>Ptilotus calostachyus</i>	+	0.6
<i>Ptilotus exaltatus</i>	+	0.6
<i>Ptilotus obovatus</i>	+	0.5
<i>Ptilotus polystachyus</i>	+	0.6
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	+	0.35
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.6
<i>Senna notabilis</i>	+	0.3
<i>Sida</i> sp. Pilbara (A.A Mitchell PRP 1543)	+	0.4
<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)	+	0.6
<i>Sida</i> sp. verrucose glands (F.H. Mollemans 2423)	+	0.2
<i>Solanum lasiophyllum</i>	+	0.7
<i>Solanum phlomoides</i>	+	0.5
<i>Tephrosia densa</i>	+	0.75
<i>Tribulus hirsutus</i>	+	0.15
<i>Tribulus macrocarpus</i>	+	prostrate
<i>Triodia epactia</i>	+	0.4
<i>Yakirra australiensis</i> var. <i>australiensis</i>	+	0.1

URS/IOH Iron Valley

Site

IOH42

Location:

m

Type: Q

50 x 50

1st Observation: Date: 16/08/2011 Described by: WT/CW

Seasonal Conditions: E

2nd Observation: Date: 29/07/2011 Described by: WTTDO

Seasonal Conditions: E

MGA Zone: 50

Easting: 736466 mE

Northing: 7483230 mN

Habitat: Flats - pediments of fingerslopes

Soil: Red brown shallow sandy loam

Rock Type: Weathered ironstone coarse fragments

Vegetation: *Eucalyptus gamophylla* scattered low trees over *Triodia lanigera* hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age:

Notes:

Species List

Name	% Cover	Height
<i>Acacia bivenosa</i>	+	4.0
<i>Acacia citrinoviridis</i>	+	2.5
<i>Acacia inaequilatera</i>	+	1.0
<i>Acacia pachyacra</i>	+	3.5
<i>Acacia tumida</i>	+	1.5
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.5
<i>Aristida inaequiglumis</i>	+	0.8
<i>Boerhavia coccinea</i>	+	0.04
<i>Cenchrus ciliaris</i>	+	0.3
<i>Cleome viscosa</i>	+	0.5
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	0.25
<i>Corchorus tectus</i>	+	0.45
<i>Cucumis maderaspatanus</i>	+	0.3
<i>Cymbopogon obtectus</i>	+	0.8
<i>Dicrastylis cordifolia</i>	+	0.35
<i>Dodonaea coriacea</i>	+	1.2
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.15
<i>Eragrostis eriopoda</i>	+	0.3
<i>Eriachne mucronata</i>	+	0.3
<i>Eriachne pulchella</i>	+	0.12
<i>Eucalyptus gamophylla</i>	1	3.0
<i>Euphorbia australis</i>	+	0.1
<i>Euphorbia biconvexa</i>	+	0.3
<i>Fimbristylis simulans</i>	+	0.1
<i>Gomphrena cunninghamii</i>	+	0.15
<i>Goodenia microptera</i>	+	0.25
<i>Goodenia stobbsiana</i>	+	0.12
<i>Grevillea wickhamii</i>	+	3.0
<i>Hakea chordophylla</i>	+	2.0
<i>Heliotropium chrysocarpum</i>	+	0.2
<i>Heliotropium cunninghamii</i>	+	0.1
<i>Hybanthus aurantiacus</i>	+	0.2
<i>Indigofera monophylla</i>	+	1.0
<i>Paraneurachne muelleri</i>	+	0.4
<i>Polycarpaea holtzei</i>	+	0.04
<i>Polycarpaea longiflora</i>	+	0.12

<i>Ptilotus auriculifolius</i>	+	0.15
<i>Ptilotus calostachyus</i>	+	0.45
<i>Ptilotus obovatus</i>	+	0.3
<i>Rhyncharrhena linearis</i>	+	0.6
<i>Schizachyrium fragile</i>	+	0.2
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	+	0.85
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.85
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	+	1.0
<i>Senna glutinosa</i> subsp. x <i>luerssenii</i>	+	1.7
<i>Senna notabilis</i>	+	0.2
<i>Sida cardiophylla</i>	+	0.45
<i>Solanum lasiophyllum</i>	+	0.2
<i>Solanum phlomoides</i>	+	0.2
<i>Tribulopsis angustifolia</i>	+	0.04
<i>Tribulus hirsutus</i>	+	0.08
<i>Trichodesma zeylanicum</i>	+	0.4
<i>Triodia epactia</i>	1	0.7
<i>Triodia lanigera</i>	35	0.7
<i>Velleia connata</i>	+	0.25
<i>Yakirra australiensis</i> var. <i>australiensis</i>	+	0.08

URS/IOH Iron Valley

Site

IOH43

Location:

m

Type: Q

50 x 50

1st Observation: Date: 16/08/2011 Described by: NC/NK

Seasonal Conditions: E

2nd Observation: Date: 2/08/2011 Described by: WTTDO

Seasonal Conditions: E

MGA Zone: 50

Easting: 737117 mE

Northing: 7485472 mN

Habitat: Upper slope of easterly sloping tall hill

Soil: Red-brown clayey sand

Rock Type: BIF shales

Vegetation: *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Acacia spondylophylla* scattered low shrubs over *Triodia* sp.(sterile), *Triodia ?wiseana* open hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 2 - 5 yrs

Notes:

Species List

Name	% Cover	Height
<i>Acacia hilliana</i>	+	0.1
<i>Acacia inaequilatera</i>	+	2.5
<i>Acacia maitlandii</i>	+	0.5
<i>Acacia spondylophylla</i>	1	0.4
<i>Amphipogon sericeus</i>	+	0.2
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.3
<i>Bonamia media</i> var. <i>villosa</i>	+	0.07
<i>Cleome viscosa</i>	+	0.05
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	0.25
<i>Dampiera candidans</i>	+	0.25
<i>Dodonaea coriacea</i>	+	0.3
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.1
<i>Eriachne lanata</i>	+	0.22
<i>Eriachne mucronata</i>	+	0.3
<i>Eriachne pulchella</i>	+	0.15
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	1	6.0
<i>Fimbristylis microcarya</i>	+	0.15
<i>Fimbristylis simulans</i>	+	0.15
<i>Gomphrena cunninghamii</i>	+	0.1
<i>Goodenia microptera</i>	+	0.25
<i>Goodenia stobbsiana</i>	+	0.15
<i>Goodenia triodiophila</i>	+	0.18
<i>Grevillea wickhamii</i>	+	1.4
<i>Heliotropium chrysocarpum</i>	+	0.25
<i>Hibiscus</i> aff. <i>coatesii</i>	+	1.0
<i>Oldenlandia crouchiana</i>	+	0.07

<i>Paraneurachne muelleri</i>	+	0.45
<i>Paspalidium clementii</i>	+	0.07
<i>Petalostylis labicheoides</i>	+	1.1
<i>Phyllanthus maderaspatensis</i>	+	0.04
<i>Polycarpaea holtzei</i>	+	0.03
<i>Polycarpaea longiflora</i>	+	0.15
<i>Polygala isingii</i>	+	0.03
<i>Ptilotus auriculifolius</i>	+	0.18
<i>Ptilotus calostachyus</i>	+	0.8
<i>Ptilotus exaltatus</i>	+	0.3
<i>Ptilotus fusiformis</i>	+	0.3
<i>Schizachyrium fragile</i>	+	0.12
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	1.1
<i>Sida</i> sp. Pilbara (A.A Mitchell PRP 1543)	+	0.3
<i>Solanum phlomoides</i>	+	0.3
<i>Tribulus suberosus</i>	+	0.25
<i>Triodia ?wiseana</i>	3	0.1
<i>Triodia epactia</i>	+	0.25
<i>Triodia</i> sp.	12	0.15

URS/IOH Iron Valley

Site

IOH44

Location:

m

Type: Q

50 x 50

1st Observation: Date: 16/08/2011 Described by: WT/CW

Seasonal Conditions: E

2nd Observation: Date: 29/07/2011 Described by: WTTDO

Seasonal Conditions: E

MGA Zone: 50 Easting: 736668 mE

Northing: 7483272 mN

Habitat: Foothills of finger hillslopes

Soil: Red brown skeletal sandy loam

Rock Type: Weathered BIF and ironstone

Vegetation: *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Triodia basedowii*, *T. epactia* open hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 5 - 10 yrs

Notes:

Species List

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.4
<i>Acacia bivenosa</i>	+	2.0
<i>Acacia citrinoviridis</i>	+	1.4
<i>Acacia dictyophleba</i>	+	1.2
<i>Acacia inaequilatera</i>	+	2.5
<i>Amphipogon sericeus</i>	+	0.4
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.35
<i>Cucumis maderaspatanus</i>	+	0.4
<i>Cymbopogon oblectus</i>	+	0.45
<i>Dicrastylis cordifolia</i>	+	0.45
<i>Dysphania kalpari</i>	+	0.03
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.1
<i>Eriachne mucronata</i>	+	0.2
<i>Eriachne pulchella</i>	+	0.18
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	1	4.0
<i>Euphorbia tannensis</i>	+	0.3
<i>Fimbristylis simulans</i>	+	0.2
<i>Gomphrena cunninghamii</i>	+	0.1
<i>Goodenia stobbsiana</i>	+	0.08
<i>Grevillea wickhamii</i>	+	1.6
<i>Hakea lorea</i>	+	3.0
<i>Oldenlandia crouchiana</i>	+	0.2
<i>Polycarpaea holtzei</i>	+	0.04
<i>Polygala isingii</i>	+	0.03
<i>Ptilotus calostachyus</i>	+	0.45
<i>Ptilotus fusiformis</i>	+	0.3
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	+	0.3
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	1.0
<i>Senna glutinosa</i> subsp. <i>x luerssenii</i>	+	0.6
<i>Sida</i> sp. Pilbara (A.A Mitchell PRP 1543)	+	0.15
<i>Trichodesma zeylanicum</i>	+	0.4
<i>Triodia basedowii</i>	20	0.55
<i>Triodia epactia</i>	1	0.7

URS/IOH Iron Valley

Site

IOH45

Location: Lower slopes of ranges in north-east of survey area **Type:** Q 50 x 50 m

1st Observation: **Date:** 16/08/2011 **Described by:** NC/NK **Seasonal Conditions:** E

2nd Observation: **Date:** 2/08/2011 **Described by:** WTTDO **Seasonal Conditions:** E

MGA Zone: 50 **Easting:** 737426 mE **Northing:** 7485390 mN

Habitat: East facing lower slope of tall hill

Soil: Orange brown sandy loam

Rock Type: Ironstone formation with rocks and exposed bedrock

Vegetation: *Acacia spondylophylla* scattered low shrubs over *Triodia* sp. Shovelanna Hill.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 5 - 10 yrs

Notes: Quadrat near drill lines

Species List

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.5
<i>Acacia hilliana</i>	+	0.25
<i>Acacia inaequilatera</i>	+	1.4
<i>Acacia maitlandii</i>	+	2.0
<i>Acacia melleodora</i>	+	0.8
<i>Acacia spondylophylla</i>	1	0.5
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.3
<i>Calytrix carinata</i>	+	1.0
<i>Eriachne lanata</i>	+	0.4
<i>Eriachne mucronata</i>	+	0.3
<i>Eriachne pulchella</i>	+	0.1
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	+	1.5
<i>Fimbristylis simulans</i>	+	0.1
<i>Grevillea wickhamii</i>	+	2.5
<i>Hakea lorea</i>	+	2.2
<i>Phyllanthus maderaspatensis</i>	+	0.03
<i>Polycarpaea holtzei</i>	+	0.02
<i>Ptilotus calostachyus</i>	+	0.3
<i>Schizachyrium fragile</i>	+	0.08
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	0.7
<i>Triodia epactia</i>	+	0.25
<i>Triodia</i> sp. Shovelanna Hill (S. van Leeuwen 3835)	20	0.2
<i>Triodia wiseana</i>	+	0.25

URS/IOH Iron Valley

Site

IOH46

Location:

m

Type: Q

50 x 50

1st Observation: Date: 16/08/2011 Described by: WT/CW

Seasonal Conditions: E

2nd Observation: Date: 29/07/2011 Described by: WTTDO

Seasonal Conditions: E

MGA Zone: 50 Easting: 736670 mE

Northing: 7482944 mN

Habitat: Pediment/outwash

Soil: Red brown, shallow

Rock Type: Ironstone gravel

Vegetation: *Corymbia hamersleyana* low open woodland over *Eucalyptus gamophylla* scattered low trees over *Cenchrus ciliaris* and *Eulalia aurea* scattered tussock grasses with *Triodia basedowii* very open hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Good

Fire Age: 5 - 10 yrs

Notes:

Species List

Name	% Cover	Height
<i>Abutilon leucopetalum</i>	+	1.0
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.65
<i>Acacia dictyophleba</i>	+	0.65
<i>Acacia holosericea</i>	+	2.2
<i>Acacia inaequilatera</i>	+	3.0
<i>Acacia pachyacra</i>	+	3.0
<i>Acacia pruinocarpa</i>	+	2.2
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.5
<i>Aristida inaequiglumis</i>	+	0.8
<i>Boerhavia coccinea</i>	+	0.1
<i>Bonamia erecta</i>	+	0.35
<i>Cenchrus ciliaris</i>	1	1.0
<i>Cleome viscosa</i>	+	0.2
<i>Corchorus tectus</i>	+	0.4
<i>Corymbia hamersleyana</i>	2	10.0
<i>Cucumis maderaspatanus</i>	+	climber
<i>Dicrastylis cordifolia</i>	+	0.65
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.03
<i>Eragrostis eriopoda</i>	+	0.45
<i>Eucalyptus gamophylla</i>	1	3.5
<i>Eulalia aurea</i>	1	0.6
<i>Euphorbia australis</i>	+	0.08
<i>Euphorbia biconvexa</i>	+	0.15
<i>Euphorbia boophthona</i>	+	0.3
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	+	0.25
<i>Gomphrena cunninghamii</i>	+	0.15
<i>Goodenia microptera</i>	+	0.2
<i>Grevillea wickhamii</i>	+	2.5
<i>Hakea chordophylla</i>	+	2.5
<i>Hakea lorea</i>	+	3.0
<i>Hibiscus sturtii</i> var. <i>platychlamys</i>	+	0.45
<i>Indigofera georgei</i>	+	1.0
<i>Marsdenia australis</i>	+	0.2
<i>Paraneurachne muelleri</i>	+	0.4

<i>Polycarpaea corymbosa</i>	+	0.18
<i>Polycarpaea longiflora</i>	+	0.25
<i>Polygala isingii</i>	+	0.03
<i>Ptilotus exaltatus</i>	+	1.0
<i>Ptilotus obovatus</i>	+	0.6
<i>Ptilotus polystachyus</i>	+	0.4
<i>Rhagodia eremaea</i>	+	1.5
<i>Rhyncharrhena linearis</i>	+	1.5
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	+	1.6
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.55
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	2.0
<i>Senna notabilis</i>	+	0.12
<i>Sida</i> sp. Pilbara (A.A Mitchell PRP 1543)	+	0.5
<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)	+	0.65
<i>Sida</i> sp. verrucose glands (F.H. Mollemans 2423)	+	0.6
<i>Solanum lasiophyllum</i>	+	0.25
<i>Tephrosia densa</i>	+	0.65
<i>Themeda triandra</i>	+	0.6
<i>Trianthema pilosa</i>	+	0.05
<i>Tribulopsis angustifolia</i>	+	0.04
<i>Tribulus hirsutus</i>	+	0.06
<i>Trichodesma zeylanicum</i>	+	0.35
<i>Triodia basedowii</i>	4	0.55
<i>Yakirra australiensis</i> var. <i>australiensis</i>	+	0.1

URS/IOH Iron Valley

Site

IOH47

Location:

m

Type: Q

50 x 50

1st Observation: Date: 16/08/2011 Described by: NC/NK Seasonal Conditions: E

2nd Observation: Date: 3/08/2011 Described by: WTTDO Seasonal Conditions: E

MGA Zone: 50 Easting: 739513 mE Northing: 7485499 mN

Habitat: Gentle northwest facing slope at base of small hill

Soil: Orange brown sandy loam

Rock Type: Ironstone rocks (scree).

Vegetation: *Triodia* sp. Shovelanna Hill open hummock grassland with *Fimbristylis simulans* scattered sedges.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 5 - 10 yrs

Notes:

Species List

Name	% Cover	Height
<i>Acacia inaequilatera</i>	+	2.3
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.4
<i>Aristida inaequiglumis</i>	+	0.75
<i>Cenchrus ciliaris</i>	+	0.35
<i>Cleome viscosa</i>	+	0.08
<i>Dicrastylis cordifolia</i>	+	0.5
<i>Eragrostis eriopoda</i>	+	0.45
<i>Eriachne aristidea</i>	+	0.15
<i>Eriachne pulchella</i>	+	0.1
<i>Fimbristylis simulans</i>	1	0.1
<i>Gomphrena cunninghamii</i>	+	0.15
<i>Gomphrena kanisii</i>	+	0.1
<i>Goodenia microptera</i>	+	0.2
<i>Gossypium australe</i>	+	0.9
<i>Grevillea wickhamii</i>	+	2.2
<i>Heliotropium cunninghamii</i>	+	0.08
<i>Indigofera monophylla</i>	+	0.5
<i>Mollugo molluginea</i>	+	0.15
<i>Oldenlandia crouchiana</i>	+	0.05
<i>Polycarpaea holtzei</i>	+	0.05
<i>Ptilotus astrolasius</i>	+	0.08
<i>Ptilotus calostachyus</i>	+	0.45
<i>Schizachyrium fragile</i>	+	0.45
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.1
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	1.7
<i>Solanum lasiophyllum</i>	+	0.35
<i>Trachymene oleracea</i>	+	0.4
<i>Trianthema glossostigma</i>	+	0.04
<i>Triodia epactia</i>	+	0.6
<i>Triodia</i> sp. Shovelanna Hill (S. van Leeuwen 3835)	10	0.2

URS/IOH Iron Valley

Site

IOH48

Location: Far southern tip of tenement
m**Type:** Q

50 x 50

1st Observation: **Date:** 18/08/2011 **Described by:** WT/CW**Seasonal Conditions:** E**2nd Observation:** **Date:** 26/07/2011 **Described by:** WTTDO**Seasonal Conditions:** E**MGA Zone:** 50**Easting:** 735829 mE**Northing:** 7480342 mN**Habitat:** Crest of upper slope of underlating BIF hills**Soil:** Red brown skeletal sandy loam**Rock Type:** BIF outcrop**Vegetation:** *Grevillea wickhamii*, *Senna glutinosa* subsp. *pruinosa* scattered shrubs over *Ptilotus calystachyus* herbland over *Triodia basedowii*, *Triodia wiseana* scattered hummock grasses.**Vegetation Code:****Vegetation Desc:****Veg Condition:** Excellent**Fire Age:** 5 - 10 yrs**Notes:** Possibly active *Pseudomys chapmani* (Pebble-Mound Mouse) in quadrat**Species List**

Name	% Cover	Height
<i>Acacia hilliana</i>	+	0.3
<i>Amphipogon sericeus</i>	+	0.2
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.4
<i>Bonamia media</i> var. <i>villosa</i>	+	0.04
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	0.4
<i>Dampiera candidans</i>	+	0.5
<i>Dodonaea coriacea</i>	+	0.4
<i>Dysphania kalpari</i>	+	0.03
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.08
<i>Enneapogon polyphyllus</i>	+	0.2
<i>Eriachne aristidea</i>	+	0.2
<i>Eriachne mucronata</i>	+	0.25
<i>Eriachne pulchella</i>	+	0.22
<i>Euphorbia australis</i>	+	0.05
<i>Fimbristylis microcarya</i>	+	0.35
<i>Fimbristylis simulans</i>	+	0.22
<i>Gomphrena cunninghamii</i>	+	0.1
<i>Goodenia muelleriana</i>	+	0.2
<i>Goodenia stobbsiana</i>	+	0.35
<i>Goodenia triodiophila</i>	+	0.3
<i>Grevillea wickhamii</i>	+	1.0
<i>Heliotropium cunninghamii</i>	+	0.15
<i>Hibiscus</i> aff. <i>coatesii</i>	+	0.3
<i>Hibiscus leptocladus</i>	+	0.3
<i>Paraneurachne muelleri</i>	+	0.35

<i>Polycarpaea holtzei</i>	+	0.04
<i>Polygala isingii</i>	+	0.03
<i>Ptilotus calostachyus</i>	+	0.4
<i>Ptilotus clementii</i>	+	0.35
<i>Ptilotus exaltatus</i>	+	0.08
<i>Ptilotus fusiformis</i>	+	0.25
<i>Ptilotus obovatus</i>	+	0.2
<i>Ptilotus rotundifolius</i>	+	0.6
<i>Schizachyrium fragile</i>	+	0.2
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	+	1.0
<i>Senna glaucifolia</i>	+	0.40
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	1.2
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	+	1.4
<i>Senna notabilis</i>	+	0.15
<i>Sida arenicola</i>	+	0.2
<i>Sida cardiophylla</i>	+	1.0
<i>Solanum lasiophyllum</i>	+	0.5
<i>Solanum phlomoides</i>	+	0.8
<i>Tephrosia</i> sp. Cathedral Gorge (F.H. Mollemans 2420)	+	0.04
<i>Tephrosia supina</i>	+	0.06
<i>Trianthema glossostigma</i>	+	prostrate
<i>Tribulus hirsutus</i>	+	0.06
<i>Tribulus suberosus</i>	+	0.3
<i>Triodia basedowii</i>	1	0.35
<i>Triodia wiseana</i>	+	0.4

URS/IOH Iron Valley

Site

IOH49

Location: Northern triangle of tenement
m**Type:** Q

50 x 50

1st Observation: **Date:** 18/08/2011 **Described by:** NC/NK**Seasonal Conditions:** E**2nd Observation:** **Date:** 2/08/2011 **Described by:** WTTDO**Seasonal Conditions:** E**MGA Zone:** 50 **Easting:** 737857 mE**Northing:** 7486378 mN**Habitat:** Open flat plain with minor drainage**Soil:** Orange brown sandy loam**Rock Type:** Ironstone rocks and shale**Vegetation:** *Grevillea wickhamii* scattered tall shrubs over *Triodia epactia* (*T. Lanigera*) open hummock grassland.**Vegetation Code:****Vegetation Desc:****Veg Condition:** Excellent**Fire Age:** 5 - 10 yrs**Notes:****Species List**

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.6
<i>Acacia ancistrocarpa</i>	+	1.0
<i>Acacia bivenosa</i>	+	2.5
<i>Acacia inaequilatera</i>	+	2.5
<i>Acacia tumida</i>	+	2.6
<i>Amphipogon sericeus</i>	+	0.25
<i>Aristida contorta</i>	+	0.25
<i>Bonamia erecta</i>	+	0.25
<i>Bonamia media</i> var. <i>villosa</i>	+	0.05
<i>Cleome viscosa</i>	+	0.4
<i>Corymbia deserticola</i>	+	4.0
<i>Dicrastylis cordifolia</i>	+	0.7
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.05
<i>Eragrostis eriopoda</i>	+	0.25
<i>Eriachne mucronata</i>	+	0.5
<i>Eriachne pulchella</i>	+	0.05
<i>Eucalyptus gamophylla</i>	+	2.2
<i>Euphorbia australis</i>	+	0.05
<i>Fimbristylis simulans</i>	+	0.2
<i>Goodenia microptera</i>	+	0.05
<i>Goodenia prostrata</i>	+	0.03
<i>Grevillea wickhamii</i>	1	3.0
<i>Haloragis gossei</i>	+	0.1
<i>Indigofera monophylla</i>	+	0.45
<i>Isotropis atropurpurea</i>	+	0.3
<i>Mollugo molluginea</i>	+	0.07
<i>Oldenlandia crouchiana</i>	+	0.05

<i>Phyllanthus maderaspatensis</i>	+	0.15
<i>Polycarpaea corymbosa</i>	+	0.07
<i>Polycarpaea holtzei</i>	+	0.03
<i>Ptilotus astrolasius</i>	+	0.12
<i>Ptilotus calostachyus</i>	+	0.6
<i>Schizachyrium fragile</i>	+	0.1
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	+	0.9
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	+	0.7
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	+	1.1
<i>Senna notabilis</i>	+	0.03
<i>Solanum phlomoides</i>	+	0.25
<i>Trianthema glossostigma</i>	+	prostrate
<i>Triodia epactia</i>	15	0.6
<i>Triodia lanigera</i>	5	0.35
<i>Yakirra australiensis</i> var. <i>australiensis</i>	+	0.06

URS/IOH Iron Valley

Site

IOH50

Location: Southern end of tenement survey boundary **Type:** Q 50 x 50 m

1st Observation: **Date:** 18/08/2011 **Described by:** WT/CW **Seasonal Conditions:** E

2nd Observation: **Date:** 26/07/2011 **Described by:** WTTDO **Seasonal Conditions:** E

MGA Zone: 50 **Easting:** 735891 mE **Northing:** 7480571 mN

Habitat: Hill footslope

Soil: Red brown shallow sandy loam

Rock Type: BIF and weathered ironstone coarse fragments

Vegetation: *Acacia inaequilatera*, *Grevillea wickhamii* scattered shrubs over *Triodia basedowii* scattered hummock grasses.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 5 - 10 yrs

Notes: Possibly new and active *Pseudomys chapmani* (Pebble-Mound Mouse) mound in quadrat

Species List

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.35
<i>Acacia bivenosa</i>	+	0.6
<i>Acacia hilliana</i>	+	0.35
<i>Acacia inaequilatera</i>	+	0.5
<i>Amphipogon sericeus</i>	+	0.22
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.18
<i>Bonamia media</i> var. <i>villosa</i>	+	0.06
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	0.45
<i>Dodonaea coriacea</i>	+	0.08
<i>Dysphania kalpari</i>	+	0.4
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.2
<i>Eriachne aristidea</i>	+	
<i>Eriachne mucronata</i>	+	0.1
<i>Eriachne pulchella</i>	+	0.12
<i>Fimbristylis simulans</i>	+	0.3
<i>Gomphrena cunninghamii</i>	+	0.12
<i>Goodenia microptera</i>	+	0.2
<i>Goodenia muelleriana</i>	+	0.15
<i>Goodenia stobbsiana</i>	+	0.25
<i>Grevillea wickhamii</i>	+	1.0
<i>Heliotropium chrysocarpum</i>	+	0.3
<i>Mollugo molluginea</i>	+	0.08
<i>Polycarpaea holtzei</i>	+	0.03
<i>Pterocaulon sphaeranthoides</i>	+	0.06
<i>Ptilotus astrolasius</i>	+	0.3
<i>Ptilotus auriculifolius</i>	+	0.4
<i>Ptilotus calostachyus</i>	+	1.0
<i>Ptilotus exaltatus</i>	+	0.5
<i>Schizachyrium fragile</i>	+	0.15
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	+	0.1
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.35
<i>Senna notabilis</i>	+	0.2
<i>Sida arenicola</i>	+	0.4
<i>Sida cardiophylla</i>	+	0.55
<i>Solanum lasiophyllum</i>	+	0.3

<i>Solanum phlomoides</i>	+	0.4
<i>Trianthema glossostigma</i>	+	0.02
<i>Tribulus hirsutus</i>	+	0.05
<i>Triodia basedowii</i>	1	0.35
<i>Triodia epactia</i>	+	0.3

URS/IOH Iron Valley

Site IOH51

Location: Northern triangle of survey area **Type:** Q 50 x 50
1st Observation: **Date:** 18/08/2011 **Described by:** NC/NK **Seasonal Conditions:** E
2nd Observation: **Date:** 2/08/2011 **Described by:** WTTDO **Seasonal Conditions:** E
MGA Zone: 50 **Easting:** 737775 mE **Northing:** 7486274 mN
Habitat: Open flat plain with tall hills to the west. Very minor depression running through quadrat
Soil: Orange brown sandy loam
Rock Type: Ironstone rocks and shales
Vegetation: *Grevillea wickhamii* scattered tall shrubs over *Acacia adoxa* var. *adoxo* scattered low shrubs over
Triodia epactia and *Triodia basedowii* hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 5 - 10 yrs

Notes:

Species List

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	1	0.8
<i>Acacia bivenosa</i>	+	1.7
<i>Acacia inaequilatera</i>	+	1.6
<i>Acacia pachyacra</i>	+	1.0
<i>Acacia pruinocarpa</i>	+	0.9
<i>Acacia tumida</i>	+	2.5
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.45
<i>Bonamia erecta</i>	+	0.3
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	0.5
<i>Dicrastylis cordifolia</i>	+	0.7
<i>Eriachne pulchella</i>	+	0.15
<i>Eucalyptus gamophylla</i>	+	2.5
<i>Euphorbia australis</i>	+	1.2
<i>Fimbristylis simulans</i>	+	0.15
<i>Grevillea wickhamii</i>	1	2.0
<i>Hakea lorea</i>	+	1.65
<i>Indigofera monophylla</i>	+	0.5
<i>Mollugo molluginea</i>	+	0.05
<i>Polycarpaea corymbosa</i>	+	0.05
<i>Polycarpaea holtzei</i>	+	0.05
<i>Polycarpaea longiflora</i>	+	0.1
<i>Portulaca oleracea</i>	+	prostrate
<i>Ptilotus calostachyus</i>	+	0.15
<i>Ptilotus exaltatus</i>	+	0.15
<i>Rhynchosia minima</i>	+	climber
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.15
<i>Senna notabilis</i>	+	0.1
<i>Trianthema glossostigma</i>	+	prostrate
<i>Trichodesma zeylanicum</i>	+	0.3
<i>Triodia basedowii</i>	20	0.4
<i>Triodia epactia</i>	25	0.65

URS/IOH Iron Valley

Site

IOH52

Location: Southern half of survey area
m**Type:** Q

50 x 50

1st Observation: **Date:** 18/08/2011 **Described by:** WT/CW**Seasonal Conditions:** E**2nd Observation:** **Date:** 26/07/2011 **Described by:** WTTDO**Seasonal Conditions:** E**MGA Zone:** 50**Easting:** 735854 mE**Northing:** 7480824 mN**Habitat:** Crest/upper slope of fingerslope hills**Soil:** Red brown skeletal sandy loam**Rock Type:** BIF**Vegetation:** *Eucalyptus leucophloia* subsp. *leucophloia*, *Corymbia deserticola* scattered low trees over *Hakea lorea* scattered tall shrubs over *Triodia basedowii* scattered hummock grasses.**Vegetation Code:****Vegetation Desc:****Veg Condition:** Excellent**Fire Age:** 5 - 10 yrs**Notes:****Species List**

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.35
<i>Acacia hilliana</i>	+	0.3
<i>Acacia inaequilatera</i>	+	1.5
<i>Amphipogon sericeus</i>	+	0.4
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.4
<i>Corymbia deserticola</i>	1	4.0
<i>Dicrastylis cordifolia</i>	+	0.7
<i>Dysphania kalpari</i>	+	0.1
<i>Eriachne mucronata</i>	+	0.45
<i>Eriachne pulchella</i>	+	0.15
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	+	4.0
<i>Fimbristylis simulans</i>	+	0.18
<i>Goodenia stobbsiana</i>	+	0.15
<i>Goodenia triodiophila</i>	+	0.3
<i>Grevillea wickhamii</i>	+	1.2
<i>Hakea lorea</i>	+	2.5
<i>Keraudrenia nephrosperma</i>	+	0.6
<i>Paraneurachne muelleri</i>	+	0.4
<i>Polycarpaea holtzei</i>	+	0.04
<i>Polygala isingii</i>	+	0.03
<i>Ptilotus auriculifolius</i>	+	0.22
<i>Ptilotus calostachyus</i>	+	0.6
<i>Ptilotus exaltatus</i>	+	0.2
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	+	0.4
<i>Senna glutinosa</i> subsp. x <i>luerssenii</i>	+	0.7
<i>Senna notabilis</i>	+	0.08
<i>Sida cardiophylla</i>	+	0.55
<i>Solanum phlomoides</i>	+	0.45
<i>Trianthema glossostigma</i>	+	0.03
<i>Triodia basedowii</i>	1	0.4
<i>Triodia epactia</i>	+	0.45

URS/IOH Iron Valley

Site

IOH53

Location:

m

Type: Q

50 x 50

1st Observation: Date: 18/08/2011 Described by: NC/NK

Seasonal Conditions: E

2nd Observation: Date: 2/08/2011 Described by: WTTDO

Seasonal Conditions: E

MGA Zone: 50 Easting: 738130 mE

Northing: 7485991 mN

Habitat: Open plain

Soil: Orange brown sandy loam

Rock Type: Ironstone rocks and shale

Vegetation: *Triodia lanigera*, *T. epactia* open hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 5 - 10 yrs

Notes:

Species List

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	1.0
<i>Acacia bivenosa</i>	+	1.3
<i>Acacia dictyophleba</i>	+	0.8
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.15
<i>Cleome viscosa</i>	+	0.3
<i>Corymbia hamersleyana</i>	+	4.0
<i>Dicrastylis cordifolia</i>	+	1.1
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.03
<i>Eriachne pulchella</i>	+	0.05
<i>Fimbristylis simulans</i>	+	0.15
<i>Grevillea wickhamii</i>	+	3.0
<i>Hakea lorea</i>	+	1.1
<i>Indigofera monophylla</i>	+	0.8
<i>Mollugo molluginea</i>	+	0.07
<i>Phyllanthus maderaspatensis</i>	+	0.07
<i>Polycarpaea corymbosa</i>	+	0.05
<i>Polycarpaea holtzei</i>	+	0.03
<i>Portulaca oleracea</i>	+	0.03
<i>Ptilotus astrolasius</i>	+	0.1
<i>Ptilotus calostachyus</i>	+	0.5
<i>Ptilotus exaltatus</i>	+	0.1
<i>Ptilotus polystachyus</i>	+	0.4
<i>Rhynchosia minima</i>	+	0.07
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	+	1.0
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.45
<i>Senna glutinosa</i> subsp. x <i>luerssenii</i>	+	1.7
<i>Trachymene oleracea</i>	+	0.3
<i>Trianthema glossostigma</i>	+	prostrate
<i>Triodia epactia</i>	8	1.0
<i>Triodia lanigera</i>	20	0.3

URS/IOH Iron Valley

Site

IOH54

Location: Southern colluvial plain of tenement **Type:** Q 50 x 50

1st Observation: **Date:** 18/08/2011 **Described by:** WT/CW **Seasonal Conditions:** E

2nd Observation: **Date:** 26/07/2011 **Described by:** WTTDO **Seasonal Conditions:** E

MGA Zone: 50 **Easting:** 736238 mE **Northing:** 7480682 mN

Habitat: Flat colluvial plain

Soil: Red brown shallow sandy loam

Rock Type: Ironstone gravel and coarse fragments

Vegetation: *Eucalyptus gamophylla* scattered low trees over *Sida arenicola* and *Abutilon leucopetalum* scattered low shrubs over *Triodia wiseana*, *T. lanigera* very open hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Good

Fire Age: 2 - 5 yrs

Notes:

Species List

Name	% Cover	Height
<i>Abutilon leucopetalum</i>	+	0.8
<i>Abutilon otocarpum</i>	1	0.4
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.3
<i>Acacia ancistrocarpa</i>	+	0.4
<i>Acacia bivenosa</i>	+	2.0
<i>Acacia hilliana</i>	+	0.3
<i>Acacia inaequilatera</i>	+	1.2
<i>Acacia pachyacra</i>	+	0.75
<i>Acacia pruinocarpa</i>	+	0.7
<i>Acacia tumida</i>	+	0.45
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.6
<i>Boerhavia coccinea</i>	+	0.1
<i>Bonamia erecta</i>	+	0.4
<i>Cenchrus ciliaris</i>	+	0.45
<i>Cleome viscosa</i>	+	0.75
<i>Corchorus lasiocarpus</i> subsp. <i>lasiocarpus</i>	+	0.6
<i>Corymbia hamersleyana</i>	+	2.5
<i>Dicrastylis cordifolia</i>	+	0.6
<i>Dysphania kalpari</i>	+	0.1
<i>Eragrostis eriopoda</i>	+	0.45
<i>Eremophila longifolia</i>	+	0.8
<i>Eriachne mucronata</i>	+	0.35
<i>Eucalyptus gamophylla</i>	1	2.2
<i>Euphorbia australis</i>	+	0.08
<i>Euphorbia biconvexa</i>	+	0.2
<i>Euphorbia tannensis</i> subsp. <i>eremophila</i>	+	1.2
<i>Gomphrena cunninghamii</i>	+	0.15
<i>Goodenia microptera</i>	+	0.3
<i>Heliotropium chrysocarpum</i>	+	0.45
<i>Hibiscus leptocladus</i>	+	0.35
<i>Hibiscus sturtii</i> var. <i>platychlamys</i>	+	0.4
<i>Hybanthus aurantiacus</i>	+	0.65
<i>Indigofera monophylla</i>	+	0.6
<i>Mollugo molluginea</i>	+	0.08
<i>Paraneurachne muelleri</i>	+	0.5
<i>Petalostylis cassioides</i>	+	1.2

<i>Polycarpaea holtzei</i>	+	0.2
<i>Polymeria ambigua</i>	+	0.05
<i>Ptilotus calostachyus</i>	+	0.6
<i>Ptilotus exaltatus</i>	+	0.5
<i>Ptilotus obovatus</i>	+	1.0
<i>Ptilotus polystachyus</i>	+	0.55
<i>Rhagodia eremaea</i>	+	0.5
<i>Scaevola parvifolia</i> subsp. <i>pilbarae</i>	+	0.3
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	+	1.25
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.7
<i>Senna notabilis</i>	+	0.4
<i>Sida arenicola</i>	+	1.2
<i>Sida cardiophylla</i>	1	0.85
<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)	+	1.1
<i>Sida</i> sp. verrucose glands (F.H. Mollemans 2423)	+	0.18
<i>Solanum phlomoides</i>	+	0.55
<i>Tephrosia densa</i>	+	0.45
<i>Tephrosia</i> sp. Bungaroo Creek (M.E. Trudgen 11601)	+	0.15
<i>Trianthema glossostigma</i>	+	0.03
<i>Trianthema pilosa</i>	+	0.1
<i>Tribulus hirsutus</i>	+	0.1
<i>Tribulus macrocarpus</i>	+	0.08
<i>Trichodesma zeylanicum</i>	+	0.12
<i>Triodia epactia</i>	+	0.55
<i>Triodia lanigera</i>	1	0.75
<i>Triodia wiseana</i>	2	0.7

URS/IOH Iron Valley

Site

IOH55

Location:

Type: Q

50 x 50

1st Observation: Date: 18/08/2011 Described by: NC/NK

Seasonal Conditions: E

2nd Observation: Date: 2/08/2011 Described by: WTTDO

Seasonal Conditions: E

MGA Zone: 50 Easting: 737646 mE

Northing: 7485967 mN

Habitat: Open flat plain with very slight depression

Soil: Orange brown sandy loam

Rock Type: Ironstone rocks and shale

Vegetation: *Triodia lanigera* and *T. epactia* open hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 5 - 10 yrs

Notes:

Species List

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.8
<i>Acacia inaequilatera</i>	+	3.2
<i>Acacia maitlandii</i>	+	1.5
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.2
<i>Calytrix carinata</i>	+	1.1
<i>Cleome viscosa</i>	+	0.4
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.03
<i>Eriachne aristidea</i>	+	0.3
<i>Eriachne pulchella</i>	+	0.05
<i>Euphorbia australis</i>	+	0.05
<i>Gomphrena cunninghamii</i>	+	0.2
<i>Grevillea wickhamii</i>	+	3.0
<i>Hakea lorea</i>	+	1.65
<i>Indigofera monophylla</i>	+	0.9
<i>Mollugo molluginea</i>	+	0.1
<i>Polycarpaea holtzei</i>	+	0.03
<i>Polycarpaea longiflora</i>	+	0.12
<i>Ptilotus auriculifolius</i>	+	0.2
<i>Ptilotus clementii</i>	+	0.2
<i>Ptilotus exaltatus</i>	+	0.35
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	1.2
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	1.2
<i>Trianthema pilosa</i>	+	0.07
<i>Trichodesma zeylanicum</i>	+	0.1
<i>Triodia epactia</i>	15	0.8
<i>Triodia lanigera</i>	15	0.4

URS/IOH Iron Valley

Site IOH56

Location: Southwestern hills of tenement **Type:** Q
1st Observation: **Date:** 18/08/2011 **Described by:** NC/NK **Seasonal Conditions:** E
2nd Observation: **Date:** 28/08/2011 **Described by:** WTTDO **Seasonal Conditions:** E
MGA Zone: 50 **Easting:** 736015 mE **Northing:** 7481563 mN
Habitat: Upper hillslope
Soil: Red brown skeletal soil
Rock Type: BIF and weathered ironstone
Vegetation: *Triodia basedowii* scattered hummock grasses.
Vegetation Code:
Vegetation Desc:
Veg Condition: Excellent
Fire Age: 2 - 5 yrs
Notes: Within quadrat was a very likely active *Pseudomys chapmani* (Pebble-Mound Mouse) and a possibly active mound adjacent to the quadrat.

Species List

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.2
<i>Acacia bivenosa</i>	+	0.4
<i>Acacia inaequilatera</i>	+	2.2
<i>Acacia tumida</i>	+	0.45
<i>Amphipogon sericeus</i>	+	0.4
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.45
<i>Boerhavia coccinea</i>	+	0.08
<i>Bonamia media</i> var. <i>villosa</i>	+	0.05
<i>Cleome viscosa</i>	+	0.18
<i>Corchorus lasiocarpus</i> subsp. <i>lasiocarpus</i>	+	0.55
<i>Corymbia hamersleyana</i>	+	0.6
<i>Cymbopogon ambiguus</i>	+	0.3
<i>Dampiera candidans</i>	+	0.4
<i>Dodonaea coriacea</i>	+	0.6
<i>Dysphania kalpari</i>	+	0.04
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.2
<i>Eriachne mucronata</i>	+	0.35
<i>Eriachne pulchella</i>	+	0.1
<i>Fimbristylis microcarya</i>	+	0.3
<i>Fimbristylis simulans</i>	+	0.18
<i>Gomphrena cunninghamii</i>	+	0.1
<i>Goodenia microptera</i>	+	0.1
<i>Goodenia stobbsiana</i>	+	0.22
<i>Goodenia triodiophila</i>	+	0.25
<i>Grevillea wickhamii</i>	+	3.0
<i>Hibiscus</i> aff. <i>coatesii</i>	+	0.3
<i>Paraneurachne muelleri</i>	+	0.5
<i>Polycarpaea holtzei</i>	+	0.03
<i>Ptilotus auriculifolius</i>	+	0.25
<i>Ptilotus calostachyus</i>	+	1.0
<i>Ptilotus clementii</i>	+	0.35
<i>Ptilotus exaltatus</i>	+	0.25
<i>Ptilotus fusiformis</i>	+	0.22
<i>Ptilotus obovatus</i>	+	0.3
<i>Ptilotus rotundifolius</i>	+	0.6
<i>Schizachyrium fragile</i>	+	0.25

<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.5
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	1.2
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	+	0.6
<i>Senna notabilis</i>	+	0.08
<i>Sida cardiophylla</i>	+	0.9
<i>Solanum phlomoides</i>	+	0.35
<i>Tephrosia</i> sp. Cathedral Gorge (F.H. Mollemans 2420)	+	0.04
<i>Triodia basedowii</i>	+	0.3
<i>Triodia epactia</i>	+	0.4
<i>Triodia wiseana</i>	+	0.3

URS/IOH Iron Valley

Site

IOH57

Location: Approximately 500m northeast of camp m **Type:** Q 50 x 50

1st Observation: **Date:** 18/08/2011 **Described by:** NC/NK **Seasonal Conditions:** E

2nd Observation: **Date:** 3/08/2011 **Described by:** WTTDO **Seasonal Conditions:** E

MGA Zone: 50 **Easting:** 739480 mE **Northing:** 7485285 mN

Habitat: Lower slope of westerly facing slope

Soil: Red brown sandy loam

Rock Type: Ironstone rocks and some exposed bedrock

Vegetation: *Acacia hilliana* low open shrubland over *Triodia* sp. Shovelanna Hill hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 5 - 10 yrs

Notes: Probably inactive *Pseudomys chapmani* (Pebble-Mound Mouse) mound.

Species List

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.4
<i>Acacia adsurgens</i>	+	0.75
<i>Acacia bivenosa</i>	+	3.0
<i>Acacia hilliana</i>	10	0.5
<i>Acacia pruinocarpa</i>	+	2.0
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.3
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	0.55
<i>Cucumis maderaspatanus</i>	+	0.35
<i>Cymbopogon ambiguus</i>	1	0.9
<i>Eremophila longifolia</i>	+	1.9
<i>Eriachne aristidea</i>	+	0.15
<i>Eriachne pulchella</i>	+	0.15
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	+	3.5
<i>Fimbristylis simulans</i>	+	0.15
<i>Goodenia stobbsiana</i>	+	0.6
<i>Grevillea wickhamii</i>	+	2.2
<i>Hakea chordophylla</i>	+	0.65
<i>Hakea lorea</i>	+	2.5
<i>Mollugo molluginea</i>	+	0.07
<i>Notoleptopus decaisnei</i>	+	0.4
<i>Polycarpaea holtzei</i>	+	0.03
<i>Pterocaulon sphaeranthoides</i>	+	0.1
<i>Ptilotus astrolasius</i>	+	0.4
<i>Ptilotus calostachyus</i>	+	0.2
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	+	0.8
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	1.1
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	+	1.8
<i>Senna notabilis</i>	+	0.1
<i>Solanum phlomoides</i>	+	0.35
<i>Trianthema glossostigma</i>	+	0.01
<i>Triodia epactia</i>	+	0.35
<i>Triodia</i> sp. Shovelanna Hill (S. van Leeuwen 3835)	45	0.25

URS/IOH Iron Valley

Site IOH58

Location: m Type: Q 50 x 50

1st Observation: Date: 18/08/2011 Described by: WT/CW Seasonal Conditions: E

2nd Observation: Date: 27/07/2011 Described by: WTTDO Seasonal Conditions: E

MGA Zone: 50 Easting: 736100 mE Northing: 7481715 mN

Habitat: Crest of BIF hillslope

Soil: Red brown, skeletal and shallow

Rock Type: BIF weathered ironstone exposed seam

Vegetation: *Triodia basedowii* scattered hummock grasses.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 2 - 5 yrs

Notes: Possible old inactive *Pseudomys chapmani* (Pebble-Mound Mouse) mound in quadrat

Species List

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.2
<i>Acacia adsurgens</i>	+	1.0
<i>Acacia bivenosa</i>	+	2.2
<i>Acacia citrinoviridis</i>	+	2.2
<i>Acacia pruinocarpa</i>	+	2.5
<i>Amphipogon sericeus</i>	+	0.3
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.3
<i>Calytrix carinata</i>	+	0.5
<i>Cleome viscosa</i>	+	0.18
<i>Corchorus lasiocarpus</i> subsp. <i>lasiocarpus</i>	+	0.45
<i>Cucumis maderaspatanus</i>	+	0.2
<i>Dampiera candidans</i>	+	0.45
<i>Eriachne mucronata</i>	+	0.35
<i>Eriachne pulchella</i>	+	0.12
<i>Euphorbia australis</i>	+	0.06
<i>Fimbristylis simulans</i>	+	0.18
<i>Goodenia stobbsiana</i>	+	0.35
<i>Goodenia triodiophila</i>	+	0.3
<i>Grevillea wickhamii</i>	+	4.0
<i>Hakea lorea</i>	+	3.5
<i>Paraneurachne muelleri</i>	+	0.3
<i>Polycarpaea holtzei</i>	+	0.05
<i>Polygala isingii</i>	+	0.03
<i>Ptilotus calostachyus</i>	+	0.8
<i>Ptilotus exaltatus</i>	+	0.3
<i>Ptilotus obovatus</i>	+	0.6
<i>Ptilotus polystachyus</i>	+	0.25
<i>Ptilotus rotundifolius</i>	+	0.6
<i>Schizachyrium fragile</i>	+	0.4
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	1.0
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	1.2
<i>Senna glutinosa</i> subsp. x <i>luerssenii</i>	+	1.6
<i>Senna notabilis</i>	+	0.15
<i>Sida arenicola</i>	+	1.6
<i>Sida cardiophylla</i>	+	0.45
<i>Solanum phlomoides</i>	+	0.4

<i>Stemodia grossa</i>	+	0.45
<i>Streptoglossa bubakii</i>	+	0.45
<i>Trachymene oleracea</i>	+	0.1
<i>Trianthema glossostigma</i>	+	0.04
<i>Tribulus suberosus</i>	+	0.5
<i>Triodia basedowii</i>	1	0.45
<i>Triodia epactia</i>	+	0.3
<i>Triodia wiseana</i>	+	0.3

URS/IOH Iron Valley

Site

IOH59

Location:

m

Type: Q

50 x 50

1st Observation: Date: 17/04/2011 Described by: NC/NK Seasonal Conditions: E

2nd Observation: Date: 27/07/2011 Described by: WTTDO Seasonal Conditions: E

MGA Zone: 50 Easting: 736207 mE Northing: 7482283 mN

Habitat: Hill crest

Soil: Orange brown sandy loam/fine sand

Rock Type: Ironstone rocks with some exposed bedrock

Vegetation: *Triodia* sp. Shovelanna Hill very open hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 2 - 5 yrs

Notes: Scattered *Eucalyptus ?leucophloia* trees in depression adjacent to quadrat

Species List

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.15
<i>Acacia bivenosa</i>	+	0.1
<i>Acacia hilliana</i>	+	0.25
<i>Acacia pruinocarpa</i>	+	0.25
<i>Amphipogon sericeus</i>	+	0.35
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.65
<i>Bonamia media</i> var. <i>villosa</i>	+	0.02
<i>Calytrix carinata</i>	+	0.06
<i>Cleome viscosa</i>	+	0.35
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	0.4
<i>Cucumis maderaspatanus</i>	+	climber
<i>Cymbopogon ambiguus</i>	+	0.9
<i>Dampiera candidans</i>	+	0.55
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.05
<i>Eragrostis eriopoda</i>	+	0.35
<i>Eriachne pulchella</i>	+	0.1
<i>Euphorbia australis</i>	+	0.15
<i>Fimbristylis simulans</i>	+	0.15
<i>Gomphrena cunninghamii</i>	+	0.07
<i>Goodenia microptera</i>	+	0.35
<i>Goodenia stobbsiana</i>	+	0.4
<i>Grevillea wickhamii</i>	+	1.2
<i>Hakea lorea</i>	+	2.5
<i>Hibiscus sturtii</i> var. <i>campylochlamys</i>	+	0.4
<i>Paraneurachne muelleri</i>	+	0.35
<i>Phyllanthus maderaspatensis</i>	+	0.1
<i>Polycarpaea holtzei</i>	+	0.03
<i>Ptilotus astrolasius</i>	+	0.1
<i>Ptilotus calostachyus</i>	+	1.1
<i>Ptilotus exaltatus</i>	+	0.6
<i>Ptilotus fusiformis</i>	+	0.3
<i>Schizachyrium fragile</i>	+	0.3
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.25
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	+	0.4
<i>Sida</i> sp. Pilbara (A.A Mitchell PRP 1543)	+	1.1
<i>Solanum phlomoides</i>	+	0.9

<i>Tephrosia</i> sp. Cathedral Gorge (F.H. Mollemans 2420)	+	0.04
<i>Trachymene oleracea</i>	+	0.03
<i>Tribulus hirsutus</i>	+	prostrate
<i>Triodia lanigera</i>	10	0.2

URS/IOH Iron Valley

Site IOH60

Location: m **Type:** Q 50 x 50

1st Observation: **Date:** 17/04/2011 **Described by:** WT/CW **Seasonal Conditions:** E

2nd Observation: **Date:** 27/07/2011 **Described by:** WTTDO **Seasonal Conditions:** E

MGA Zone: 50 **Easting:** 735965 mE **Northing:** 7481180 mN

Habitat: Colluvial drainage off hillslope

Soil: Red brown shallow

Rock Type: BIF and occasional coarse fragments of ironstone gravel

Vegetation: *Eucalyptus gamophylla* scattered low trees over *Acacia tumida* scattered shrubs over *Corchorus lasiocarpus* subsp. *parvus* scattered low shrubs.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 0 - 2 years

Notes: Post fire

Species List

Name	% Cover	Height
<i>Abutilon lepidum</i>	+	0.75
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.3
<i>Acacia adsurgens</i>	+	0.4
<i>Acacia ancistrocarpa</i>	+	0.4
<i>Acacia dictyophleba</i>	+	0.7
<i>Acacia inaequilatera</i>	+	2.2
<i>Acacia pachyacra</i>	+	1.6
<i>Acacia tumida</i>	1	1.0
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.6
<i>Aristida inaequiglumis</i>	+	1.2
<i>Atalaya hemiglauc</i>	+	1.4
<i>Bonamia erecta</i>	+	0.4
<i>Bonamia media</i> var. <i>villosa</i>	+	0.06
<i>Cenchrus ciliaris</i>	+	0.5
<i>Cleome viscosa</i>	+	0.55
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	1	0.45
<i>Cullen lachnostachys</i>	+	0.3
<i>Dicrastylis cordifolia</i>	+	0.7
<i>Duperreya commixta</i>	+	1.4
<i>Dysphania kalpari</i>	+	0.08
<i>Enneapogon polyphyllus</i>	+	0.2
<i>Eragrostis eriopoda</i>	+	0.5
<i>Eucalyptus gamophylla</i>	1	4.0
<i>Euphorbia australis</i>	+	0.1
<i>Euphorbia biconvexa</i>	+	0.25
<i>Goodenia microptera</i>	+	0.2
<i>Goodenia muelleriana</i>	+	0.3
<i>Goodenia stobbsiana</i>	+	0.3
<i>Gossypium robinsonii</i>	+	2.2
<i>Grevillea wickhamii</i>	+	2.0
<i>Heliotropium chrysocarpum</i>	+	0.3
<i>Hibiscus leptocladus</i>	+	0.4
<i>Hibiscus sturtii</i> var. <i>campylochlamys</i>	+	0.35
<i>Hibiscus sturtii</i> var. <i>platychlamys</i>	+	0.7
<i>Hybanthus aurantiacus</i>	+	0.5

<i>Indigofera monophylla</i>	+	0.55
<i>Jasminum didymum</i> subsp. <i>lineare</i>	+	1.0
<i>Keraudrenia nephrosperma</i>	+	0.8
<i>Polycarpaea holtzei</i>	+	0.04
<i>Polycarpaea longiflora</i>	+	0.15
<i>Pterocaulon sphaeranthoides</i>	+	0.2
<i>Ptilotus astrolasius</i>	+	0.4
<i>Ptilotus auriculifolius</i>	+	0.45
<i>Ptilotus calostachyus</i>	+	1.0
<i>Ptilotus exaltatus</i>	+	0.45
<i>Ptilotus polystachyus</i>	+	0.35
<i>Rhynchosia minima</i>	+	0.12
<i>Scaevola parvifolia</i> subsp. <i>pilbarae</i>	+	0.3
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.45
<i>Senna ferraria</i>	+	0.7
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	0.45
<i>Senna notabilis</i>	+	0.4
<i>Sida arenicola</i>	+	1.2
<i>Sida cardiophylla</i>	+	0.7
<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)	+	1.0
<i>Sida</i> sp. verrucose glands (F.H. Mollemans 2423)	+	0.1
<i>Tephrosia</i> aff. <i>supina</i>	+	0.1
<i>Tephrosia densa</i>	+	0.5
<i>Themeda triandra</i>	+	0.4
<i>Trachymene oleracea</i>	+	1.0
<i>Trianthema pilosa</i>	+	0.06
<i>Tribulus hirsutus</i>	+	0.08
<i>Tribulus macrocarpus</i>	+	0.06
<i>Trichodesma zeylanicum</i>	+	0.35
<i>Triodia epactia</i>	+	0.3
<i>Triodia wiseana</i>	+	0.25

URS/IOH Iron Valley

Site

IOH61

Location:

m

Type: Q

50 x 50

1st Observation: Date: 17/04/2011 Described by: NC/NK Seasonal Conditions: E

2nd Observation: Date: 27/07/2011 Described by: WTTDO Seasonal Conditions: E

MGA Zone: 50 Easting: 736145 mE Northing: 7482090 mN

Habitat: Colluvial flat plain south of minor drainage line and between low hills

Soil: Red brown clayey sand

Rock Type: Ironstone

Vegetation: *Corchorus tectus* and *Bonamia erecta*, *Sida* sp. Pilbara, *Hibiscus sturtii* var. *platyklamys* open herbland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 2 - 5 yrs

Notes: Fire disturbance evident

Species List

Name	% Cover	Height
<i>Abutilon trudenii</i>	+	0.8
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.3
<i>Acacia adsurgens</i>	+	0.25
<i>Acacia dictyophleba</i>	+	1.0
<i>Acacia inaequilatera</i>	+	3.5
<i>Acacia pachyacra</i>	+	0.9
<i>Acacia tumida</i> var. <i>pilbarensis</i>	+	0.5
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.5
<i>Bonamia erecta</i>	5	0.4
<i>Chrysopogon fallax</i>	+	1.3
<i>Cleome viscosa</i>	+	0.55
<i>Corchorus tectus</i>	15	0.35
<i>Corymbia opaca</i>	+	1.6
<i>Cucumis maderaspatanus</i>	+	2.0
<i>Dicrastylis cordifolia</i>	+	0.6
<i>Dysphania kalpari</i>	+	0.05
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.2
<i>Eragrostis eriopoda</i>	+	0.6
<i>Euphorbia australis</i>	+	0.08
<i>Goodenia microptera</i>	+	0.1
<i>Goodenia stobbsiana</i>	+	0.1
<i>Grevillea wickhamii</i>	+	1.2
<i>Hibiscus sturtii</i> var. <i>platyklamys</i>	1	0.5
<i>Hybanthus aurantiacus</i>	+	0.75

<i>Indigofera monophylla</i>	+	0.4
<i>Jasminum didymum</i> subsp. <i>lineare</i>	+	0.9
<i>Paraneurachne muelleri</i>	+	0.4
<i>Pterocaulon sphaeranthoides</i>	+	0.08
<i>Ptilotus astrolasius</i>	+	0.4
<i>Ptilotus calostachyus</i>	+	0.4
<i>Ptilotus exaltatus</i>	+	0.8
<i>Ptilotus polystachyus</i>	+	0.5
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	+	0.25
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	+	0.8
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.7
<i>Senna notabilis</i>	+	0.08
<i>Sida arenicola</i>	+	1.1
<i>Sida</i> sp. Pilbara (A.A Mitchell PRP 1543)	2	0.5
<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)	+	1.3
<i>Solanum phlomoides</i>	+	0.55
<i>Trianthema pilosa</i>	+	0.05
<i>Tribulus hirsutus</i>	+	creeper
<i>Tribulus macrocarpus</i>	+	creeper
<i>Trichodesma zeylanicum</i>	+	0.2
<i>Triodia epactia</i>	+	0.25
<i>Triodia</i> sp.	+	0.15
<i>Yakirra australiensis</i> var. <i>australiensis</i>	+	0.07

URS/IOH Iron Valley

Site

IOH62

Location: Southwest tenement boundary
m**Type:** Q

50 x 50

1st Observation: **Date:** 17/04/2011 **Described by:** WT/CW**Seasonal Conditions:** E**2nd Observation:** **Date:** 26/07/2011 **Described by:** WTTDO**Seasonal Conditions:** E**MGA Zone:** 50 **Easting:** 735762 mE**Northing:** 7481319 mN**Habitat:** Lower slope of finger slope**Soil:** Red brown shallow sandy loam**Rock Type:** Weathered BIF angular coarse fragments**Vegetation:** *Triodia epactia*, *T. wiseana* very open hummock grassland.**Vegetation Code:****Vegetation Desc:****Veg Condition:** Excellent**Fire Age:** 2 - 5 yrs**Notes:**

Species List

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.3
<i>Acacia bivenosa</i>	+	0.3
<i>Acacia pruinocarpa</i>	+	0.3
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.6
<i>Bonamia media</i> var. <i>villosa</i>	+	0.05
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	0.55
<i>Corchorus tectus</i>	+	0.5
<i>Dysphania kalpari</i>	+	0.04
<i>Eriachne aristidea</i>	+	.2
<i>Eriachne mucronata</i>	+	0.2
<i>Eucalyptus gamophylla</i>	+	2.0
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	+	0.12
<i>Fimbristylis microcarya</i>	+	0.4
<i>Fimbristylis simulans</i>	+	0.1
<i>Goodenia stobbsiana</i>	+	0.3
<i>Goodenia triodiophila</i>	+	0.3
<i>Grevillea wickhamii</i>	+	0.6
<i>Hakea lorea</i>	+	4.5
<i>Hibiscus coatesii</i>	+	0.55
<i>Hibiscus sturtii</i> var. <i>campylochlamys</i>	+	0.3
<i>Paraneurachne muelleri</i>	+	0.5
<i>Polycarpaea holtzei</i>	+	0.03
<i>Polygala isingii</i>	+	0.03
<i>Ptilotus auriculifolius</i>	+	0.1
<i>Ptilotus calostachyus</i>	+	0.5
<i>Ptilotus exaltatus</i>	+	0.6
<i>Ptilotus fusiformis</i>	+	0.35
<i>Ptilotus polystachyus</i>	+	0.4
<i>Ptilotus rotundifolius</i>	+	0.6
<i>Schizachyrium fragile</i>	+	0.4
<i>Senna ferraria</i>	+	0.6
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	1.0
<i>Senna glutinosa</i> subsp. <i>x luerksenii</i>	+	1.3
<i>Sida arenicola</i>	+	1.0
<i>Solanum phlomoides</i>	+	0.5
<i>Tephrosia supina</i>	+	0.05

<i>Triodia basedowii</i>	+	0.2
<i>Triodia epactia</i>	2	0.5
<i>Triodia wiseana</i>	1	0.3

URS/IOH Iron Valley

Site

IOH63r

Location: Near IOH61

Type: R

1st Observation: Date: 17/04/2011 Described by: NC/NK

Seasonal Conditions: E

2nd Observation: Date: 27/07/2011 Described by: WTTDO

Seasonal Conditions: E

MGA Zone: 50

Easting: 736194 mE

Northing: 7482120 mN

Habitat: Minor incised drainage channel leading to shallow drainage

Soil: Orange brown clayey sand

Rock Type: Ironstone

Vegetation: *Acacia tumida*, *Gossypium robinsonii* tall shrubland over *Tephrosia rosea* scattered low shrubs.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 2 - 5 yrs

Notes:

Species List

Name	% Cover	Height
<i>Abutilon otocarpum</i>	+	0.35
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.20
<i>Acacia tumida</i>	10	1.70
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.60
<i>Boerhavia coccinea</i>	+	prostrate
<i>Bonamia erecta</i>	+	0.60
<i>Bonamia media</i> var. <i>villosa</i>	+	prostrate
<i>Cleome viscosa</i>	+	0.40
<i>Corchorus lasiocarpus</i> subsp. <i>lasiocarpus</i>	+	0.50
<i>Cullen lachnostachys</i>	+	0.60
<i>Dampiera candidans</i>	+	0.40
<i>Eriachne mucronata</i>	+	0.40
<i>Gomphrena cunninghamii</i>	+	0.10
<i>Goodenia stobbsiana</i>	+	0.40
<i>Gossypium robinsonii</i>	2	2.10
<i>Grevillea wickhamii</i>	+	0.50
<i>Hybanthus aurantiacus</i>	+	0.55
<i>Indigofera monophylla</i>	+	0.25
<i>Jasminum didymum</i> subsp. <i>lineare</i>	+	0.50
<i>Paraneurachne muelleri</i>	+	0.60
<i>Polycarpaea holtzei</i>	+	0.03
<i>Polycarpaea longiflora</i>	+	0.10
<i>Ptilotus astrolasius</i>	+	0.45
<i>Ptilotus exaltatus</i>	+	0.60
<i>Rhynchosia minima</i>	+	0.05
<i>Senna notabilis</i>	+	0.20
<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)	+	2.0
<i>Solanum phlomoides</i>	+	0.30
<i>Tephrosia densa</i>	+	0.6
<i>Tephrosia rosea</i>	1	0.45
<i>Themeda triandra</i>	+	0.70
<i>Triodia</i> sp. (<i>epactia/pungens</i>)	+	0.40

URS/IOH Iron Valley

Site IOH64

Location: m **Type:** Q 50 x 50

1st Observation: **Date:** 17/04/2011 **Described by:** WT/CW **Seasonal Conditions:** E

2nd Observation: **Date:** 27/07/2011 **Described by:** WTTDO **Seasonal Conditions:** E

MGA Zone: 50 **Easting:** 736527 mE **Northing:** 7481175 mN

Habitat: Colluvial outwash plain

Soil: Red brown shallow sandy loam

Rock Type: BIF weathered coarse fragments

Vegetation: *Acacia pruinocarpa* scattered tall shrubs over *Corchorus tectus* and *Scaevola parvifolia* subsp. *pilbarae* low open shrubland over *Triodia wiseana* very open hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 0 - 2 yrs

Notes: **Cenchrus ciliaris* (approx. 10 specimens) within minor creek adjacent to quadrat

Species List

Name	% Cover	Height
<i>Abutilon otocarpum</i>	+	0.30
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.30
<i>Acacia ancistrocarpa</i>	+	0.20
<i>Acacia inaequilatera</i>	+	2.20
<i>Acacia pruinocarpa</i>	1	5.00
<i>Acacia pyrifolia</i>	+	0.50
<i>Acacia tumida</i>	+	0.45
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.55
<i>Bonamia erecta</i>	+	0.30
<i>Cenchrus ciliaris</i>	+	0.40
<i>Cleome viscosa</i>	+	0.45
<i>Corchorus tectus</i>	1	0.50
<i>Corymbia hamersleyana</i>	+	8.00
<i>Cucumis maderaspatanus</i>	+	climber
<i>Dicrastylis cordifolia</i>	+	0.50
<i>Dysphania kalpari</i>	+	0.12
<i>Eragrostis eriopoda</i>	+	0.45
<i>Euphorbia australis</i>	+	0.12
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	+	0.20
<i>Goodenia microptera</i>	+	0.40
<i>Gossypium robinsonii</i>	+	0.70
<i>Grevillea wickhamii</i>	+	0.70
<i>Hakea lorea</i>	+	0.60
<i>Hibiscus sturtii</i> var. <i>platychlamys</i>	+	0.20
<i>Hybanthus aurantiacus</i>	+	0.35
<i>Indigofera monophylla</i>	+	0.35

<i>Mollugo molluginea</i>	+	0.06
<i>Petalostylis labicheoides</i>	+	1.00
<i>Phyllanthus maderaspatensis</i>	+	0.08
<i>Polycarpaea corymbosa</i>	+	0.12
<i>Polycarpaea holtzei</i>	+	0.30
<i>Ptilotus astrolasius</i>	+	0.30
<i>Ptilotus exaltatus</i>	+	0.35
<i>Ptilotus polystachyus</i>	+	0.60
<i>Rhynchosia minima</i>	+	climber
<i>Scaevola parvifolia</i> subsp. <i>pilbarae</i>	1	0.25
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	+	0.40
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.75
<i>Senna notabilis</i>	+	0.18
<i>Sida</i> sp. Pilbara (A.A Mitchell PRP 1543)	+	0.45
<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)	+	1.60
<i>Sida</i> sp. verrucose glands (F.H. Mollemans 2423)	+	0.20
<i>Solanum lasiophyllum</i>	+	0.50
<i>Solanum phlomoides</i>	+	0.40
<i>Solanum sturtianum</i>	+	0.20
<i>Tephrosia rosea</i>	+	0.15
<i>Trianthema pilosa</i>	+	0.05
<i>Tribulus hirsutus</i>	+	0.12
<i>Tribulus macrocarpus</i>	+	0.10
<i>Trichodesma zeylanicum</i>	+	0.30
<i>Triodia epactia</i>	+	0.30
<i>Triodia wiseana</i>	2	0.70

URS/IOH Iron Valley

Site

IOH65

Location: Far south of camp
m

Type: Q

50 x 50

1st Observation: Date: 17/04/2011 Described by: NC/NK

Seasonal Conditions: E

2nd Observation: Date: 18/08/2011 Described by: WTTDO

Seasonal Conditions: E

MGA Zone: 50

Easting: 737145 mE

Northing: 7482132 mN

Habitat: Open flat plain

Soil: Orange brown clayey sand

Rock Type: Ironstone rocks in patches but largely absent

Vegetation: *Sida* sp. verrucose glands and mixed spp. herbland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Good

Fire Age: 0 - 2 yrs

Notes: Presence of **Cenchrus ciliaris*, fire and cattle disturbance

Species List

Name	% Cover	Height
<i>Abutilon otocarpum</i>	+	0.60
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.30
<i>Acacia ancistrocarpa</i>	+	0.80
<i>Acacia aptaneura</i>	+	1.30
<i>Acacia citrinoviridis</i>	+	0.50
<i>Acacia inaequilatera</i>	+	2.50
<i>Acacia pachyacra</i>	+	1.10
<i>Acacia tumida</i>	+	1.10
<i>Acacia tumida</i> var. <i>pilbarensis</i>	+	0.60
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.30
<i>Boerhavia coccinea</i>	+	0.20
<i>Bonamia erecta</i>	+	0.50
<i>Bonamia media</i> var. <i>villosa</i>	+	0.03
<i>Cenchrus ciliaris</i>	+	0.50
<i>Cenchrus setiger</i>	+	0.50
<i>Chrysopogon fallax</i>	+	1.40
<i>Cleome viscosa</i>	+	0.60
<i>Corchorus lasiocarpus</i> subsp. <i>lasiocarpus</i>	+	0.70
<i>Corchorus tectus</i>	+	0.60
<i>Corymbia hamersleyana</i>	+	5.00
<i>Cucumis maderaspatanus</i>	+	climber
<i>Dicrastylis cordifolia</i>	+	0.05
<i>Dysphania kalpari</i>	+	0.10
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.15

<i>Eragrostis eriopoda</i>	+	0.40
<i>Eriachne aristidea</i>	+	0.45
<i>Eucalyptus gamophylla</i>	+	1.90
<i>Euphorbia australis</i>	+	0.05
<i>Euphorbia tannensis</i> subsp. <i>eremophila</i>	+	0.60
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	+	0.15
<i>Gomphrena cunninghamii</i>	+	0.05
<i>Goodenia microptera</i>	+	
<i>Goodenia stobbsiana</i>	+	0.20
<i>Gossypium australe</i>	+	0.45
<i>Gossypium robinsonii</i>	+	1.50
<i>Grevillea wickhamii</i>	+	1.00
<i>Hibiscus sturtii</i> var. <i>campylochlamys</i>	+	0.40
<i>Hibiscus sturtii</i> var. <i>platychlamys</i>	+	0.4
<i>Indigofera georgei</i>	+	0.10
<i>Indigofera monophylla</i>	+	0.15
<i>Jasminum didymum</i> subsp. <i>lineare</i>	+	climber
<i>Paraneurachne muelleri</i>	+	0.05
<i>Perotis rara</i>	+	0.15
<i>Petalostylis labicheoides</i>	+	1.10
<i>Phyllanthus maderaspatensis</i>	+	0.20
<i>Polycarpaea corymbosa</i>	+	0.15
<i>Polycarpaea holtzei</i>	+	0.05
<i>Polycarpaea longiflora</i>	+	0.30
<i>Portulaca oleracea</i>	+	prostrate
<i>Pterocaulon sphaeranthoides</i>	+	0.05
<i>Ptilotus astrolasius</i>	+	0.40
<i>Ptilotus auriculifolius</i>	+	0.25
<i>Ptilotus exaltatus</i>	+	1.00
<i>Ptilotus fusiformis</i>	+	0.22
<i>Ptilotus obovatus</i>	+	0.45
<i>Ptilotus polystachyus</i>	+	0.50
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	+	0.40
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	+	0.50
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.40
<i>Senna notabilis</i>	+	0.15
<i>Sida</i> sp. Pilbara (A.A Mitchell PRP 1543)	+	0.15
<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)	+	1.40
<i>Sida</i> sp. verrucose glands (F.H. Mollemans 2423)	1	0.25
<i>Sporobolus australasicus</i>	+	0.20
<i>Tephrosia densa</i>	+	0.40
<i>Tephrosia rosea</i>	+	0.60
<i>Themeda triandra</i>	+	0.55
<i>Tragus australianus</i>	+	0.10
<i>Trianthema pilosa</i>	+	prostrate
<i>Trichodesma zeylanicum</i>	+	0.20
<i>Triodia</i> sp (epactia/pungens)	+	0.40

URS/IOH Iron Valley

Site

IOH66

Location: Southern third of tenement
m

Type: Q

50 x 50

1st Observation: Date: 18/04/2011 Described by: WT/CW

Seasonal Conditions: E

2nd Observation: Date: 27/07/2011 Described by: WTTDO

Seasonal Conditions: E

MGA Zone: 50 Easting: 736475 mE

Northing: 7481753 mN

Habitat: Mid slope of finger hillslope

Soil: Red brown, shallow

Rock Type: Weathered ironstone

Vegetation: *Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835) scattered hummock grasses.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 2 - 5 yrs

Notes:

Species List

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.20
<i>Acacia bivenosa</i>	+	0.55
<i>Acacia inaequilatera</i>	+	0.70
<i>Acacia pruinocarpa</i>	+	1.00
<i>Amphipogon sericeus</i>	+	0.40
<i>Bonamia media</i> var. <i>villosa</i>	+	0.05
<i>Corchorus lasiocarpus</i> subsp. <i>lasiocarpus</i>	+	0.45
<i>Cucumis maderaspatanus</i>	+	climber
<i>Cymbopogon oblectus</i>	+	0.20
<i>Dampiera candidans</i>	+	0.45
<i>Dodonaea coriacea</i>	+	1.30
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.06
<i>Eriachne aristidea</i>	+	0.22
<i>Eriachne lanata</i>	+	0.45
<i>Eriachne mucronata</i>	+	0.30
<i>Eriachne pulchella</i>	+	0.10
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	+	13.00
<i>Fimbristylis simulans</i>	+	0.18
<i>Goodenia microptera</i>	+	0.20
<i>Goodenia muelleriana</i>	+	0.35
<i>Goodenia stobbsiana</i>	+	0.35
<i>Goodenia triodiophila</i>	+	0.30
<i>Grevillea wickhamii</i>	+	2.50
<i>Hakea chordophylla</i>	+	3.00
<i>Heliotropium chrysocarpum</i>	+	0.40
<i>Keraudrenia velutina</i> subsp. <i>elliptica</i>	+	0.30
<i>Polycarpaea holtzei</i>	+	0.04
<i>Polygala isingii</i>	+	0.02
<i>Ptilotus astrolasius</i>	+	0.12
<i>Ptilotus calostachyus</i>	+	0.50
<i>Ptilotus exaltatus</i>	+	0.20
<i>Ptilotus fusiformis</i>	+	0.30
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.30
<i>Senna glutinosa</i> subsp. x <i>luerssenii</i>	+	1.00
<i>Sida</i> sp. Pilbara (A.A Mitchell PRP 1543)	+	0.35
<i>Solanum phlomoides</i>	+	1.20

<i>Tephrosia</i> sp. Cathedral Gorge (F.H. Mollemans 2420)	+	0.04
<i>Trianthema glossostigma</i>	+	0.04
<i>Triodia basedowii</i>	+	0.35
<i>Triodia</i> sp. Shovelanna Hill (S. van Leeuwen 3835)	1	0.30

URS/IOH Iron Valley

Site

IOH67

Location:

m

Type: Q

50 x 50

1st Observation: Date: 17/04/2011 Described by: NC/NK

Seasonal Conditions: E

2nd Observation: Date: 27/07/2011 Described by: WTTDO

Seasonal Conditions: E

MGA Zone: 50 Easting: 737154 mE

Northing: 7482306 mN

Habitat: Open flat plain

Soil: Orange brown clayey sand

Rock Type: Ironstone rocks and shale

Vegetation: *Corchorus tectus* scattered herbs over *Triodia lanigera* very open hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 0 - 2 yrs

Notes:

Species List

Name	% Cover	Height
<i>Abutilon otocarpum</i>	+	0.50
<i>Abutilon trudenii</i>	+	0.10
<i>Acacia ancistrocarpa</i>	+	0.15
<i>Acacia dictyophleba</i>	+	0.45
<i>Acacia inaequilatera</i>	1	3.50
<i>Acacia pachyacra</i>	+	1.50
<i>Acacia pruinocarpa</i>	+	0.60
<i>Acacia tumida</i> var. <i>pilbarensis</i>	+	0.50
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.35
<i>Boerhavia coccinea</i>	+	prostrate
<i>Bonamia erecta</i>	+	0.45
<i>Cenchrus ciliaris</i>	+	0.50
<i>Chrysopogon fallax</i>	+	0.90
<i>Cleome viscosa</i>	+	0.60
<i>Corchorus tectus</i>	1	0.35
<i>Corymbia hamersleyana</i>	+	5.50
<i>Cucumis maderaspatanus</i>	+	climber
<i>Dampiera candidans</i>	+	0.55
<i>Duperreya commixta</i>	+	climber
<i>Dysphania kalpari</i>	+	0.30
<i>Eragrostis eriopoda</i>	+	0.50
<i>Eremophila longifolia</i>	+	0.80
<i>Eriachne aristidea</i>	+	0.40
<i>Eriachne pulchella</i>	+	0.15
<i>Euphorbia australis</i>	+	0.15
<i>Euphorbia biconvexa</i>	+	0.45

<i>Euphorbia tannensis</i>	+	0.30
<i>Gomphrena cunninghamii</i>	+	0.15
<i>Goodenia microptera</i>	+	0.25
<i>Goodenia stobbsiana</i>	+	0.40
<i>Gossypium australe</i>	+	1.00
<i>Grevillea wickhamii</i>	+	1.10
<i>Hakea chordophylla</i>	+	0.60
<i>Hibiscus sturtii</i> var. <i>platyklamys</i>	+	0.40
<i>Indigofera monophylla</i>	+	0.35
<i>Ipomoea polymorpha</i>	+	0.10
<i>Jasminum didymum</i> subsp. <i>lineare</i>	+	1.00
<i>Paraneurachne muelleri</i>	+	0.45
<i>Perotis rara</i>	+	0.10
<i>Petalostylis labicheoides</i>	+	1.10
<i>Phyllanthus maderaspatensis</i>	+	0.10
<i>Polycarpaea holtzei</i>	+	0.03
<i>Polycarpaea longiflora</i>	+	0.40
<i>Portulaca oleracea</i>	+	prostrate
<i>Pterocaulon sphaeranthoides</i>	+	0.18
<i>Ptilotus astrolasius</i>	+	0.35
<i>Ptilotus calostachyus</i>	+	1.10
<i>Ptilotus exaltatus</i>	+	0.60
<i>Ptilotus gaudichaudii</i>	+	0.30
<i>Ptilotus obovatus</i>	+	0.60
<i>Ptilotus polystachyus</i>	+	0.50
<i>Salsola tragus</i>	+	0.45
<i>Sclerolaena cornishiana</i>	+	0.15
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	+	0.50
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	+	0.30
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.25
<i>Senna notabilis</i>	+	0.15
<i>Sida arenicola</i>	+	1.10
<i>Sida</i> sp. Pilbara (A.A Mitchell PRP 1543)	+	0.90
<i>Sida</i> sp. verrucose glands (F.H. Mollemans 2423)	+	0.15
<i>Solanum lasiophyllum</i>	+	0.40
<i>Solanum phlomoides</i>	+	0.15
<i>Sporobolus australasicus</i>	+	0.50
<i>Tephrosia rosea</i>	+	0.15
<i>Tephrosia</i> sp. Bungaroo Creek (M.E. Trudgen 11601)	+	0.12
<i>Tribulus hirsutus</i>	+	prostrate
<i>Tribulus macrocarpus</i>	+	prostrate
<i>Trichodesma zeylanicum</i>	+	0.10
<i>Triodia epactia</i>	+	0.50
<i>Triodia lanigera</i>	5	0.25
<i>Yakirra australiensis</i> var. <i>australiensis</i>	+	0.05

URS/IOH Iron Valley

Site

IOH68

Location: Southeastern flats
m

Type: Q

50 x 50

1st Observation: Date: 18/04/2011 Described by: WT/CW

Seasonal Conditions: E

2nd Observation: Date: 28/07/2011 Described by: WTTDO

Seasonal Conditions: E

MGA Zone: 50 Easting: 737029 mE

Northing: 7481682 mN

Habitat: Colluvial plain/outwash

Soil: Red brown sandy loam

Rock Type: Weathered ironstone coarse fragments and gravel

Vegetation: *Sida cardiophylla* very open herbland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 0 - 2 yrs

Species List

Name	% Cover	Height
<i>Abutilon otocarpum</i>	+	0.35
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.30
<i>Acacia ancistrocarpa</i>	+	0.40
<i>Acacia inaequilatera</i>	+	2.80
<i>Acacia pachyacra</i>	+	0.40
<i>Acacia tumida</i> var. <i>pilbarensis</i>	+	1.00
<i>Bonamia erecta</i>	+	0.40
<i>Cleome viscosa</i>	+	1.00
<i>Corchorus tectus</i>	+	0.40
<i>Dicrastylis cordifolia</i>	+	0.60
<i>Dysphania kalpari</i>	+	0.15
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.40
<i>Eragrostis eriopoda</i>	+	0.35
<i>Eriachne aristidea</i>	+	0.20
<i>Euphorbia australis</i>	+	0.12
<i>Goodenia microptera</i>	+	0.30
<i>Grevillea wickhamii</i>	+	1.30
<i>Haloragis gossei</i> var. <i>gossei</i>	+	0.12
<i>Heliotropium chrysocarpum</i>	+	0.35
<i>Hibiscus sturtii</i> var. <i>platychlamys</i>	+	0.50
<i>Indigofera monophylla</i>	+	0.55
<i>Paraneurachne muelleri</i>	+	0.60
<i>Petalostylis labicheoides</i>	+	1.30
<i>Polycarpaea holtzei</i>	+	0.03
<i>Ptilotus astrolasius</i>	+	0.25
<i>Ptilotus calostachyus</i>	+	0.80
<i>Ptilotus exaltatus</i>	+	0.85
<i>Scaevola parvifolia</i> subsp. <i>pilbarae</i>	+	0.25
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	+	0.45
<i>Senna notabilis</i>	+	0.2
<i>Sida cardiophylla</i>	2	1.20
<i>Solanum sturtianum</i>	+	0.55
<i>Trianthema pilosa</i>	+	0.06
<i>Tribulus hirsutus</i>	+	0.06
<i>Trichodesma zeylanicum</i>	+	0.30
<i>Tridodia lanigera</i>	+	0.30
<i>Yakirra australiensis</i> var. <i>australiensis</i>	+	0.15

URS/IOH Iron Valley

Site

IOH69r

Location: Between camp and laydown yard**Type:** R**1st Observation:** **Date:** 17/04/2011 **Described by:** NC/NK**Seasonal Conditions:** E**2nd Observation:** **Date:** 3/08/2011 **Described by:** WTTDO**Seasonal Conditions:** E**MGA Zone:** 50**Easting:** 739337 mE**Northing:** 7484947 mN**Habitat:** Shallow ephemeral minor creek running east-west**Soil:** Red brown rocks and shallow sandy loam**Rock Type:** Ironstone rock and shale**Vegetation:** *Acacia tumida* var. *pilbarensis*, *Gossypium robinsonii* tall shrubland over **Cenchrus setiger* and **C. ciliaris* very open tussock grassland over *Triodia epactia* very open hummock grassland**Vegetation Code:****Vegetation Desc:****Veg Condition:** Excellent**Fire Age:** 5 - 10 yrs**Notes:****Species List**

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.30
<i>Acacia pyrifolia</i>	+	2.00
<i>Acacia tumida</i> var. <i>pilbarensis</i>	15	4.00
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.30
<i>Atalaya hemiglauc</i>	+	3.00
<i>Bonamia erecta</i>	+	0.25
<i>Cenchrus ciliaris</i>	1	0.60
<i>Cenchrus setiger</i>	1	0.80
<i>Cleome viscosa</i>	+	0.30
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	0.50
<i>Cucumis maderaspatanus</i>	+	climber
<i>Cymbopogon oblectus</i>	+	1.20
<i>Eriachne mucronata</i>	+	0.40
<i>Eriachne tenuiculmis</i>	+	0.30
<i>Fimbristylis simulans</i>	+	0.10
<i>Goodenia microptera</i>	+	0.45
<i>Gossypium robinsonii</i>	1	3.00
<i>Grevillea wickhamii</i>	+	2.50
<i>Hybanthus aurantiacus</i>	+	0.50
<i>Paraneurachne muelleri</i>	+	0.50
<i>Petalostylis labicheoides</i>	+	2.00
<i>Polycarpaea holtzei</i>	+	0.03
<i>Polycarpaea longiflora</i>	+	0.10
<i>Ptilotus astrolasius</i>	+	0.55
<i>Santalum lanceolatum</i>	+	2.20
<i>Tephrosia rosea</i>	+	0.45
<i>Themeda triandra</i>	+	0.60
<i>Trichodesma zeylanicum</i>	+	0.10
<i>Triodia epactia</i>	3	0.40

URS/IOH Iron Valley

Site

IOH70

Location: Eastern outcropping
m**Type:** Q

50 x 50

1st Observation: **Date:** 18/04/2011 **Described by:** WT/CW**Seasonal Conditions:** E**2nd Observation:** **Date:** 29/07/2011 **Described by:** WTTDO**Seasonal Conditions:** E**MGA Zone:** 50 **Easting:** 737406 mE**Northing:** 7482928 mN**Habitat:** Crest of outcrop**Soil:** Red brown, shallow**Rock Type:** Weathered ironstone- bedrock and coarse fragments**Vegetation:** *Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over *Triodia* sp. Shovelanna Hill very open hummock grassland.**Vegetation Code:****Vegetation Desc:****Veg Condition:** Excellent**Fire Age:** 0 - 2 yrs**Notes:****Species List**

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	0.35
<i>Acacia bivenosa</i>	+	2.00
<i>Acacia dictyophleba</i>	+	0.45
<i>Acacia pachyacra</i>	+	0.30
<i>Acacia pruinocarpa</i>	+	1.00
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.30
<i>Bonamia media</i> var. <i>villosa</i>	+	0.06
<i>Bulbostylis barbata</i>	+	0.08
<i>Cleome viscosa</i>	+	0.10
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	0.25
<i>Cullen lachnostachys</i>	+	0.55
<i>Dysphania kalpari</i>	+	0.12
<i>Eragrostis eriopoda</i>	+	0.45
<i>Eriachne pulchella</i>	+	0.18
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	3	5.50
<i>Euphorbia australis</i>	+	0.12
<i>Gomphrena affinis</i> subsp. <i>pilbarensis</i>	+	0.15
<i>Gomphrena cunninghamii</i>	+	0.12
<i>Goodenia muelleriana</i>	+	0.40
<i>Goodenia stobbsiana</i>	+	0.15
<i>Goodenia triodiophila</i>	+	0.30
<i>Gossypium australe</i>	+	0.40
<i>Grevillea wickhamii</i>	+	0.55
<i>Haloragis gossei</i> var. <i>gossei</i>	+	0.06
<i>Heliotropium chrysocarpum</i>	+	0.20
<i>Hibiscus sturtii</i> var. <i>campylochlamys</i>	+	0.25

<i>Mollugo molluginea</i>	+	0.10
<i>Oldenlandia crouchiana</i>	+	0.08
<i>Paraneurachne muelleri</i>	+	0.45
<i>Polycarpaea corymbosa</i>	+	0.10
<i>Polycarpaea holtzei</i>	+	0.04
<i>Polycarpaea longiflora</i>	+	0.12
<i>Polygala isingii</i>	+	0.03
<i>Ptilotus auriculifolius</i>	+	0.25
<i>Ptilotus calostachyus</i>	+	0.60
<i>Ptilotus exaltatus</i>	+	0.15
<i>Schizachyrium fragile</i>	+	0.20
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.45
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	+	1.00
<i>Sida arenicola</i>	+	1.60
<i>Sida</i> sp. Pilbara (A.A Mitchell PRP 1543)	+	0.45
<i>Solanum phlomoides</i>	+	0.15
<i>Tephrosia supina</i>	+	0.08
<i>Trachymene oleracea</i>	+	0.35
<i>Tribulus hirsutus</i>	+	0.06
<i>Triodia basedowii</i>	+	0.25
<i>Triodia epactia</i>	+	0.35
<i>Triodia</i> sp. Shovelanna Hill (S. van Leeuwen 3835)	2	0.20
<i>Triodia wiseana</i>	+	0.30

URS/IOH Iron Valley

Site

IOH71

Location:

m

Type: Q

50 x 50

1st Observation: Date: 18/04/2011 Described by: NC/NK

Seasonal Conditions: E

2nd Observation: Date: 1/08/2011 Described by: WTTDO

Seasonal Conditions: E

MGA Zone: 50 Easting: 738534 mE

Northing: 7484229 mN

Habitat: Crest of low hill

Soil: Orange brown fine sandy loam

Rock Type: Ironstone rocks and exposed bedrock

Vegetation: *Acacia bivenosa* scattered tall shrubs over *Triodia* sp. Shovelanna Hill, *T. wiseana* hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 5 - 10 yrs

Notes: Scattered *Eucalyptus leucophloia* (?subsp. *leucophloia*) adjacent to quadrat

Species List

Name	% Cover	Height
<i>Acacia bivenosa</i>	1	3.50
<i>Acacia hilliana</i>	+	0.45
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.15
<i>Bonamia media</i> var. <i>villosa</i>	+	0.05
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	0.10
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.07
<i>Eragrostis eriopoda</i>	+	0.30
<i>Eriachne pulchella</i>	+	0.10
<i>Fimbristylis simulans</i>	+	0.15
<i>Gomphrena kanisii</i>	+	0.15
<i>Goodenia triodiophila</i>	+	0.40
<i>Grevillea wickhamii</i>	+	2.50
<i>Mollugo molluginea</i>	+	0.10
<i>Polycarpaea corymbosa</i>	+	0.10
<i>Polycarpaea holtzei</i>	+	0.03
<i>Ptilotus astrolasius</i>	+	0.20
<i>Ptilotus calostachyus</i>	+	
<i>Ptilotus exaltatus</i>	+	0.02
<i>Schizachyrium fragile</i>	+	0.10
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	0.40
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	+	1.30
<i>Senna glutinosa</i> subsp. x <i>luerssenii</i>	+	1.50
<i>Sporobolus australasicus</i>	+	0.10
<i>Triodia</i> sp. Shovelanna Hill (S. van Leeuwen 3835)	40	0.25
<i>Triodia wiseana</i>	5	0.30

URS/IOH Iron Valley

Site

IOH72r

Location: Creekline just west of camp **Type:** R 200 m

1st Observation: **Date:** 18/04/2011 **Described by:** WT/CW **Seasonal Conditions:** E

2nd Observation: **Date:** 1/08/2011 **Described by:** WTTDO **Seasonal Conditions:** E

MGA Zone: 50 **Easting:** 738910 mE **Northing:** 7485007 mN

Habitat: Minor creekline

Soil: Red brown

Rock Type: Ironstone rocks and gravel

Vegetation: *Corymbia hamersleyana* low open woodland over *Acacia tumida* var. *pilbarensis* and *Grevillea wickhamii* tall open shrubland over **Cenchrus ciliaris* with *Triodia epactia*, *Themeda triandra* tussock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Fair

Fire Age:

Notes:

Species List

Name	% Cover	Height
<i>Acacia tumida</i> var. <i>pilbarensis</i>	+	6.5
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.5
<i>Atalaya hemiglauca</i>	+	2.2
<i>Cenchrus ciliaris</i>	35	0.6
<i>Cenchrus setiger</i>	+	0.3
<i>Cleome viscosa</i>	+	0.4
<i>Corchorus tectus</i>	+	0.25
<i>Corymbia hamersleyana</i>	5	8.0
<i>Cucumis maderaspatanus</i>	+	1.0
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.3
<i>Eriachne tenuiculmis</i>	1	0.45
<i>Eulalia aurea</i>	+	0.2
<i>Euphorbia biconvexa</i>	+	0.22
<i>Fimbristylis simulans</i>	+	0.2
<i>Goodenia microptera</i>	+	0.3
<i>Gossypium robinsonii</i>	+	2.5
<i>Grevillea wickhamii</i>	4	6.0
<i>Indigofera monophylla</i>	+	0.25
<i>Paraneurachne muelleri</i>	+	0.6
<i>Petalostylis labicheoides</i>	+	1.6
<i>Polycarpaea longiflora</i>	+	0.2
<i>Ptilotus astrolasius</i>	+	0.2
<i>Ptilotus exaltatus</i>	+	0.3
<i>Santalum lanceolatum</i>	+	2.0
<i>Scaevola spinescens</i>	+	1.5
<i>Tephrosia densa</i>	+	0.6
<i>Tephrosia rosea</i>	+	0.5
<i>Themeda triandra</i>	3	0.7
<i>Trachymene oleracea</i>	+	0.3
<i>Trichodesma zeylanicum</i>	+	0.4
<i>Triodia epactia</i>	10	0.7

URS/IOH Iron Valley

Site

IOH73

Location: Approximately 700 m south of camp east of main m **Type:** Q 50 x 50

1st Observation: **Date:** 18/04/2011 **Described by:** NC/NK **Seasonal Conditions:** E

2nd Observation: **Date:** 1/08/2011 **Described by:** WTTDO **Seasonal Conditions:** E

MGA Zone: 50 **Easting:** 738758 mE **Northing:** 7484277 mN

Habitat: Narrow plain between low hills, possible floodplain in wet season

Soil: Red brown fine clayey sand

Rock Type:

Vegetation: *Corymbia hamersleyana* scattered trees over *Acacia citrinoviridis* tall open shrubland over *Gossypium australe* scattered shrubs over *Eulalia aurea*, *Themeda triandra* tussock grassland and *Triodia epactia* very open hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 5 - 10 yrs

Notes: Very little **Cenchrus ciliaris*

Species List

Name	% Cover	Height
<i>Abutilon otocarpum</i>	+	0.5
<i>Acacia adsurgens</i>	+	2.2
<i>Acacia ancistrocarpa</i>	+	1.1
<i>Acacia citrinoviridis</i>	2	3.5
<i>Acacia pachyacra</i>	+	0.5
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.3
<i>Bidens bipinnata</i>	+	0.5
<i>Boerhavia coccinea</i>	+	prostrate
<i>Bonamia erecta</i>	+	0.3
<i>Cenchrus ciliaris</i>	1	0.60
<i>Cenchrus setiger</i>	+	0.5
<i>Chrysopogon fallax</i>	+	1.3
<i>Cleome viscosa</i>	+	0.3
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	0.4
<i>Corchorus tectus</i>	+	0.4
<i>Corymbia hamersleyana</i>	2	10
<i>Crotalaria medicaginea</i> var. <i>neglecta</i>	+	0.35
<i>Cucumis maderaspatanus</i>	+	climber
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.1
<i>Eragrostis eriopoda</i>	+	0.45
<i>Eriachne aristidea</i>	+	0.35
<i>Eriachne mucronata</i>	+	0.6
<i>Eucalyptus gamophylla</i>	+	2.5
<i>Eulalia aurea</i>	50	0.5
<i>Euphorbia biconvexa</i>	+	0.6
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	+	0.2
<i>Fimbristylis simulans</i>	+	0.2
<i>Gomphrena cunninghamii</i>	+	0.2
<i>Gomphrena kanisii</i>	+	0.15
<i>Goodenia microptera</i>	+	0.05
<i>Goodenia muelleriana</i>	+	0.4
<i>Gossypium australe</i>	1	0.4
<i>Grevillea wickhamii</i>	+	3.0
<i>Hakea chordophylla</i>	+	0.9

<i>Hibiscus sturtii</i> var. <i>platyklamys</i>	+	0.3
<i>Hybanthus aurantiacus</i>	+	0.4
<i>Indigofera georgei</i>	+	0.4
<i>Indigofera monophylla</i>	+	0.5
<i>Mollugo molluginea</i>	+	0.1
<i>Paraneurachne muelleri</i>	+	0.4
<i>Paspalidium clementii</i>	+	0.07
<i>Perotis rara</i>	+	0.15
<i>Petalostylis labicheoides</i>	+	2.0
<i>Phyllanthus maderaspatensis</i>	+	0.1
<i>Polycarpaea corymbosa</i>	+	0.15
<i>Polycarpaea holtzei</i>	+	0.05
<i>Polycarpaea longiflora</i>	+	0.4
<i>Pterocaulon sphaeranthoides</i>	+	0.06
<i>Ptilotus calostachyus</i>	+	0.8
<i>Ptilotus exaltatus</i>	+	0.4
<i>Rhyncharrhena linearis</i>	+	climber
<i>Rhynchosia minima</i>	+	climber
<i>Salsola tragus</i>	+	0.5
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	+	0.5
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	+	1.0
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	0.8
<i>Senna notabilis</i>	+	0.1
<i>Sida arenicola</i>	+	0.3
<i>Sida</i> sp. Pilbara (A.A Mitchell PRP 1543)	+	0.5
<i>Sida</i> sp. <i>verrucose glands</i> (F.H. Mollemans 2423)	+	0.2
<i>Sporobolus australasicus</i>	+	0.2
<i>Streptoglossa bubakii</i>	+	0.08
<i>Themeda triandra</i>	1	1.0
<i>Trianthema pilosa</i>	+	0.05
<i>Tribulus macrocarpus</i>	+	creeper
<i>Trichodesma zeylanicum</i>	+	0.3
<i>Triodia epactia</i>	5	0.55
<i>Triodia wiseana</i>	+	0.3
<i>Yakirra australiensis</i> var. <i>australiensis</i>	+	0.1

URS/IOH Iron Valley

Site

IOH75

Location:

m

Type: Q

50 x 50

1st Observation: Date: 18/04/2011 Described by: NC/NK

Seasonal Conditions: E

2nd Observation: Date: 1/08/2011 Described by: WTTDO

Seasonal Conditions: E

MGA Zone: 50

Easting: 738971 mE

Northing: 7484646 mN

Habitat: Open flat plain below low hill to east

Soil: Orange brown fine sandy loam

Rock Type: Ironstone rocks

Vegetation: *Eucalyptus gamophylla* scattered low trees over *Acacia bivenosa* scattered tall shrubs over *Triodia lanigera* hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 5 - 10 yrs

Notes:

Species List

Name	% Cover	Height
<i>Acacia adoxa</i> var. <i>adoxo</i>	+	1.0
<i>Acacia ancistrocarpa</i>	+	2.3
<i>Acacia bivenosa</i>	1	4.5
<i>Acacia pachyacra</i>	+	2.2
<i>Acacia pruinocarpa</i>	+	0.15
<i>Aristida holathera</i> var. <i>holathera</i>	+	0.4
<i>Bonamia erecta</i>	+	0.45
<i>Cenchrus ciliaris</i>	+	0.1
<i>Cleome viscosa</i>	+	0.05
<i>Corchorus tectus</i>	+	0.2
<i>Cucumis maderaspatanus</i>	+	1.5
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.05
<i>Eragrostis eriopoda</i>	+	0.2
<i>Eucalyptus gamophylla</i>	1	2.4
<i>Euphorbia australis</i>	0.1	+
<i>Goodenia microptera</i>	+	0.05
<i>Hakea chordophylla</i>	+	3.5
<i>Hakea lorea</i>	+	2.2
<i>Hybanthus aurantiacus</i>	+	0.1
<i>Petalostylis labicheoides</i>	+	1.1
<i>Phyllanthus maderaspatensis</i>	+	0.02
<i>Pterocaulon sphaeranthoides</i>	+	0.25
<i>Ptilotus exaltatus</i>	+	0.1
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	+	1.1
<i>Senna notabilis</i>	+	0.1
<i>Sida</i> sp. Pilbara (A.A Mitchell PRP 1543)	+	0.12
<i>Triodia epactia</i>	+	0.3
<i>Triodia lanigera</i>	50	0.4
<i>Triodia wiseana</i>	+	0.45
<i>Yakirra australiensis</i> var. <i>australiensis</i>	+	0.05

URS/IOH Iron Valley

Site IOH77

Location: Approximately 150 m south of laydown yard m **Type:** Q 50 x 50

1st Observation: **Date:** 18/08/2011 **Described by:** NC/NK **Seasonal Conditions:** E

2nd Observation: **Date:** 3/08/2011 **Described by:** WTTDO **Seasonal Conditions:** E

MGA Zone: 50 **Easting:** 739242 mE **Northing:** 7484790 mN

Habitat: Gentle northern facing mid-slope of low stoney hill

Soil: Red brown clayey sand

Rock Type: Ironstone

Vegetation: *Eucalyptus leucophloia* subsp. *leucophloia* scattered low trees over *Triodia lanigera* open hummock grassland.

Vegetation Code:

Vegetation Desc:

Veg Condition: Excellent

Fire Age: 5 - 10 yrs

Notes:

Species List

Name	% Cover	Height
<i>Acacia bivenosa</i>	+	3.3
<i>Acacia citrinoviridis</i>	+	1.3
<i>Aristida contorta</i>	+	0.3
<i>Bonamia erecta</i>	+	0.35
<i>Cleome viscosa</i>	+	0.3
<i>Corymbia hamersleyana</i>	+	1.8
<i>Duperreya commixta</i>	+	climber
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	+	0.08
<i>Eriachne pulchella</i>	+	0.1
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	1	7.0
<i>Fimbristylis simulans</i>	+	0.15
<i>Mollugo molluginea</i>	+	0.02
<i>Ptilotus calostachyus</i>	+	0.7
<i>Ptilotus exaltatus</i>	+	0.25
<i>Ptilotus obovatus</i>	+	0.45
<i>Schizachyrium fragile</i>	+	0.2
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	+	1.0
<i>Senna glutinosa</i> subsp. <i>x luerssenii</i>	+	1.2
<i>Trachymene oleracea</i>	+	0.2
<i>Trianthema glossostigma</i>	+	0.03
<i>Tribulus macrocarpus</i>	+	creeper
<i>Tribulus suberosus</i>	+	1.0
<i>Triodia epactia</i>	+	0.4
<i>Triodia lanigera</i>	25	0.25

URS/IOH Iron Valley

Site

IOH-OPPORTUNISTIC RECORDS

Location:

Type:

1st Observation: Date: 1/08/2011 Described by: WTTDO

Seasonal Conditions:

2nd Observation: Date: 29/09/2011 Described by:

Seasonal Conditions:

MGA Zone: Easting: mE

Northing: mN

Habitat:

Soil:

Rock Type:

Vegetation:

Vegetation Code:

Vegetation Desc:

Veg Condition:

Fire Age:

Notes:

Species List

Name	% Cover	Height
<i>Clerodendrum floribundum</i> var. <i>angustifolium</i>		
<i>Crotalaria novae-hollandiae</i> subsp. <i>novae-hollandiae</i>		
<i>Ficus brachypoda</i>		
<i>Sida</i> sp. <i>Excedentifolia</i> (J.L. Egan 1925)	+	0.2
<i>Triumfetta maconochieana</i>	+	0.3

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Appendix L: Quadrat and Relevé Photographs

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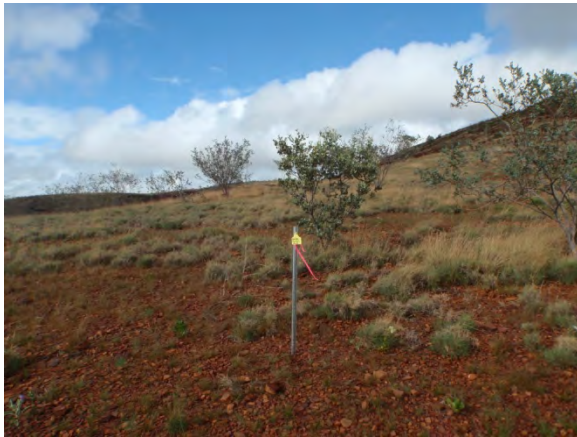


Plate 1: Quadrat IOH01, April 2011



Plate 2: Quadrat IOH01, July/August 2011



Plate 3: Quadrat IOH02, April 2011

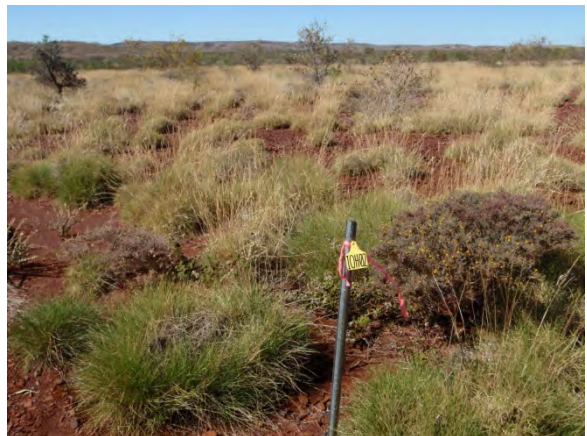


Plate 4: Quadrat IOH02, July/August 2011



Plate 5: Quadrat IOH03, April 2011



Plate 6: Quadrat IOH03, July/August 2011



Plate 7: Quadrat IOH04, April 2011



Plate 8: Quadrat IOH04, July/August 2011



Plate 9: Quadrat IOH05, April 2011



Plate 10: Quadrat IOH05, July/August 2011



Plate 11: Quadrat IOH06, April 2011



Plate 12: Quadrat IOH06, July/August 2011

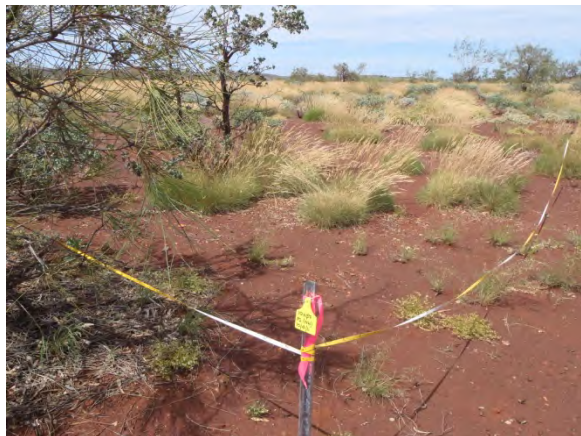


Plate 13: Quadrat IOH07, April 2011

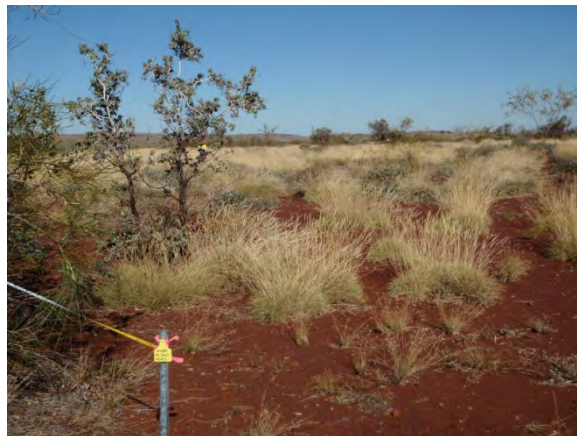


Plate 14: Quadrat IOH07, July/August 2011



Plate 15: Quadrat IOH08, April 2011



Plate 16: Quadrat IOH08, July/August 2011



Plate 17: Quadrat IOH09, April 2011



Plate 18: Quadrat IOH09, July/August 2011



Plate 19: Quadrat IOH10, April 2011



Plate 20: Quadrat IOH10, July/August 2011



Plate 21: Relevé IOH11r, April 2011 (facing southeast)



Plate 22: Relevé IOH11r, April 2011 (facing northwest)



Plate 23: Relevé IOH11r, July/August 2011 (facing southeast)



Plate 24: Relevé IOH11r, July/August 2011 (facing northwest)



Plate 25: Quadrat IOH12, April 2011



Plate 26: Quadrat IOH12, July/August 2011



Plate 27: Quadrat IOH13, April 2011



Plate 28: Quadrat IOH13, July/August 2011



Plate 29: Quadrat IOH14, April 2011



Plate 30: Quadrat IOH14, July/August 2011



Plate 31: Quadrat IOH15, April 2011

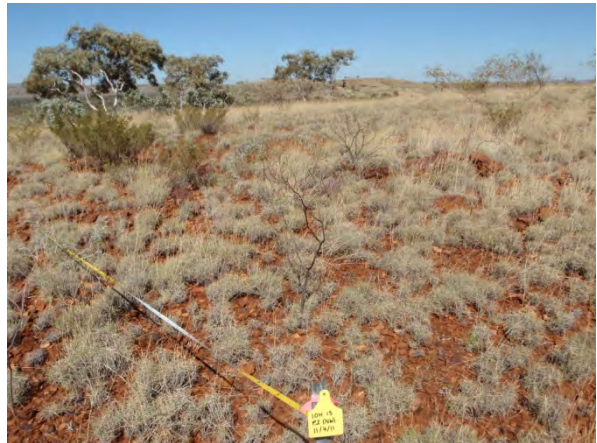


Plate 32: Quadrat IOH15, July/August 2011



Plate 33: Quadrat IOH16, April 2011



Plate 34: Quadrat IOH16, July/August 2011



Plate 35: Quadrat IOH17, April 2011



Plate 36: Quadrat IOH17, July/August 2011



Plate 37: Quadrat IOH18, April 2011

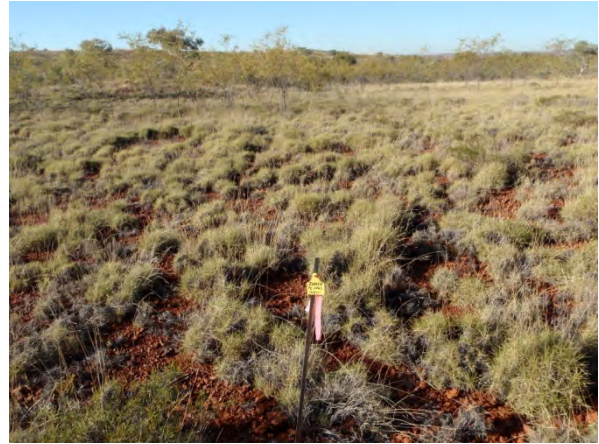


Plate 38: Quadrat IOH18, July/August 2011



Plate 39: Quadrat IOH19, April 2011



Plate 40: Quadrat IOH19, July/August 2011



Plate 41: Quadrat IOH20, April 2011



Plate 42: Quadrat IOH20, July/August 2011



Plate 43: Quadrat IOH21, April 2011



Plate 44: Quadrat IOH21, July/August 2011



Plate 45: Quadrat IOH22, April 2011



Plate 46: Quadrat IOH22, July/August 2011



Plate 47: Quadrat IOH23, April 2011



Plate 48: Quadrat IOH23, July/August 2011



Plate 49: Quadrat IOH24, April 2011



Plate 50: Quadrat IOH24, July/August 2011



Plate 51: Quadrat IOH25, April 2011



Plate 52: Quadrat IOH25, July/August 2011



Plate 53: Quadrat IOH26, April 2011



Plate 54: Quadrat IOH26, July/August 2011



Plate 55: Quadrat IOH27, April 2011



Plate 56: Quadrat IOH27, July/August 2011



Plate 57: Quadrat IOH28, April 2011



Plate 58: Quadrat IOH28, July/August 2011



Plate 59: Relevé IOH29r, April 2011 (facing east)



Plate 60: Relevé IOH29r, April 2011 (facing west)



Plate 61: Relevé IOH29r, July/August 2011 (facing east)



Plate 62: Relevé IOH29r, July/August 2011 (facing west)

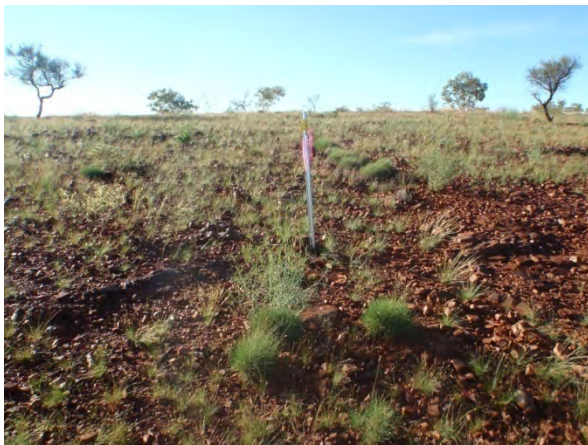


Plate 63: Quadrat IOH30, April 2011



Plate 64: Quadrat IOH30, July/August 2011



Plate 65: Quadrat IOH31, April 2011



Plate 66: Quadrat IOH31, July/August 2011



Plate 67: Quadrat IOH32, April 2011



Plate 68: Quadrat IOH32, July/August 2011



Plate 69: Quadrat IOH33, April 2011



Plate 70: Quadrat IOH33, July/August 2011



Plate 71: Quadrat IOH34, April 2011



Plate 72: Quadrat IOH34, July/August 2011



Plate 73: Quadrat IOH35, April 2011



Plate 74: Quadrat IOH35, July/August 2011



Plate 75: Quadrat IOH36, April 2011



Plate 76: Quadrat IOH36, July/August 2011



Plate 77: Quadrat IOH37, April 2011



Plate 78: Quadrat IOH37, July/August 2011



Plate 79: Quadrat IOH38, April 2011



Plate 80: Quadrat IOH38, July/August 2011



Plate 81: Relevé IOH39r, April 2011 (facing west)



Plate 82: Relevé IOH39r, April 2011 (facing east)



Plate 83: Relevé IOH39r, July/August 2011 (facing west)



Plate 84 Relevé IOH39r, July/August 2011 (facing east)



Plate 85: Quadrat IOH40, April 2011 facing south



Plate 86: Quadrat IOH40, July/August 2011 facing southeast



Plate 87: Quadrat IOH41, April 2011



Plate 88: Quadrat IOH41, July/August 2011



Plate 89: Quadrat IOH42, April 2011



Plate 90: Quadrat IOH42, July/August 2011



Plate 91: Quadrat IOH43, April 2011



Plate 92: Quadrat IOH43, July/August 2011



Plate 93: Quadrat IOH44, April 2011



Plate 94: Quadrat IOH44, July/August 2011



Plate 95: Quadrat IOH45, April 2011



Plate 96: Quadrat IOH45, July/August 2011



Plate 97: Quadrat IOH46, April 2011



Plate 98: Quadrat IOH46, July/August 2011



Plate 99: Quadrat IOH47, April 2011

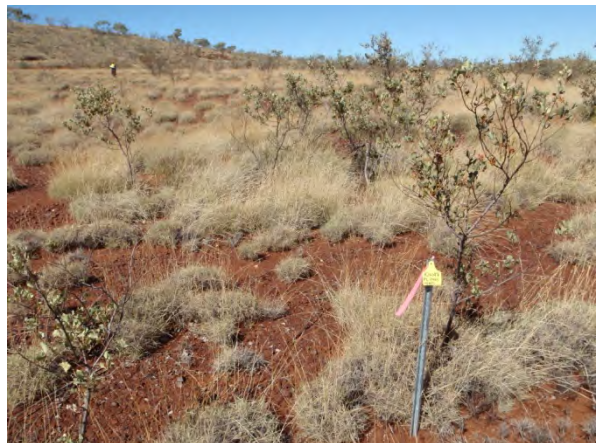


Plate 100: Quadrat IOH47, July/August 2011

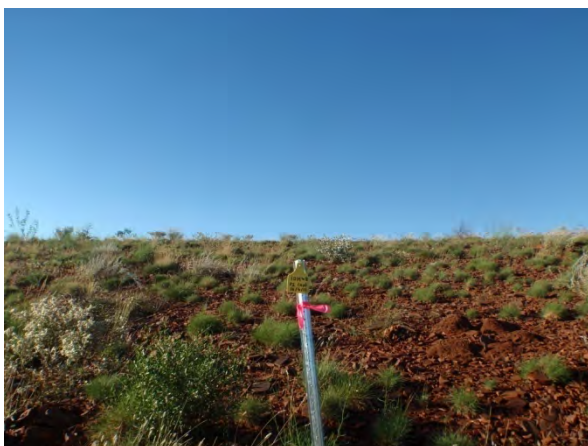


Plate 101: Quadrat IOH48, April 2011



Plate 102: Quadrat IOH48, July/August 2011



Plate 103: Quadrat IOH49, April 2011



Plate 104: Quadrat IOH49, July/August 2011



Plate 105: Quadrat IOH50, April 2011



Plate 106: Quadrat IOH50, July/August 2011



Plate 107: Quadrat IOH51, April 2011



Plate 108: Quadrat IOH51, July/August 2011



Plate 109: Quadrat IOH52, April 2011



Plate 110: Quadrat IOH52, July/August 2011



Plate 111: Quadrat IOH53, April 2011



Plate 112: Quadrat IOH53, July/August 2011



Plate 113: Quadrat IOH54, April 2011



Plate 114: Quadrat IOH54, July/August 2011



Plate 115: Quadrat IOH55, April 2011



Plate 116: Quadrat IOH55, July/August 2011



Plate 117: Quadrat IOH56, April 2011



Plate 118: Quadrat IOH56, July/August 2011



Plate 119: Quadrat IOH57, April 2011



Plate 120: Quadrat IOH57, July/August 2011



Plate 121: Quadrat IOH58, April 2011



Plate 122: Quadrat IOH58, July/August 2011



Plate 123: Quadrat IOH59, April 2011



Plate 124: Quadrat IOH59, July/August 2011



Plate 125: Quadrat IOH60, April 2011

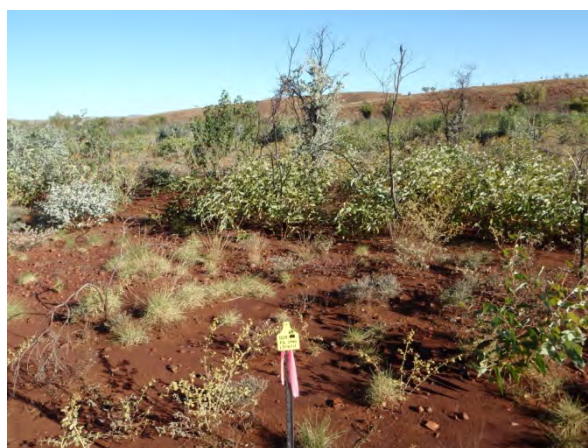


Plate 126: Quadrat IOH60, July/August 2011



Plate 127: Quadrat IOH61, April 2011



Plate 128: Quadrat IOH61, July/August 2011



Plate 129: Quadrat IOH62, April 2011



Plate 130: Quadrat IOH62, July/August 2011

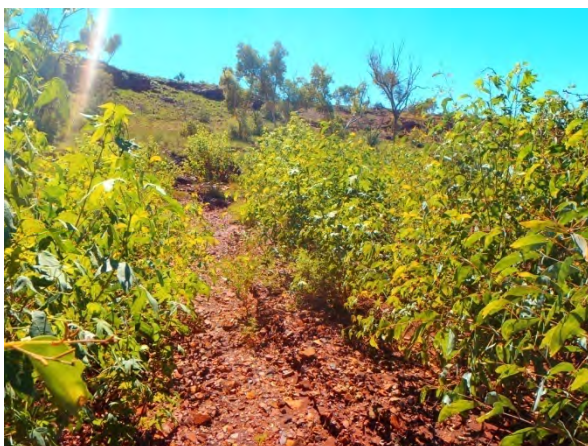


Plate 131: Relevé IOH63r, April 2011 (facing northeast)



Plate 132: Relevé IOH63r, April 2011 (facing west)



Plate 133: Relevé IOH63r, July/August 2011 (facing northeast)



Plate 134: Relevé IOH63r, July/August 2011 (facing west)



Plate 135: Quadrat IOH64, April 2011



Plate 136: Quadrat IOH64, July/August 2011



Plate 137: Quadrat IOH65, April 2011



Plate 138: Quadrat IOH65, July/August 2011

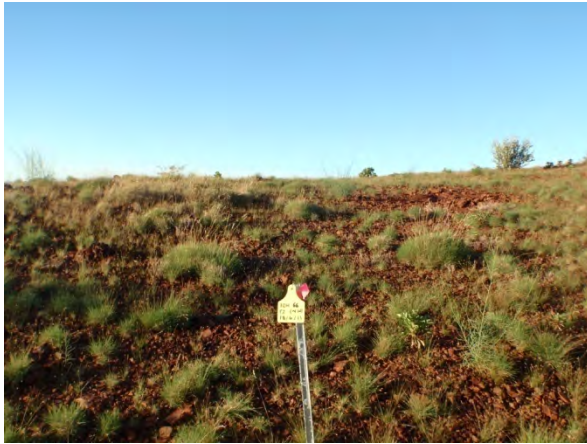


Plate 139: Quadrat IOH66, April 2011



Plate 140: Quadrat IOH66, July/August 2011



Plate 141: Quadrat IOH67, April 2011



Plate 142: Quadrat IOH67, July/August 2011



Plate 143: Quadrat IOH68, April 2011



Plate 144: Quadrat IOH68, July/August 2011



Plate 145: Relevé IOH69r, April 2011 (facing east)



Plate 146: Relevé IOH69r, April 2011 (facing west)



Plate 147: Relevé IOH69r, July/August 2011 (facing east)



Plate 148: Relevé IOH69r, July/August 2011 (facing west)



Plate 149: Quadrat IOH70, April 2011



Plate 150: Quadrat IOH70, July/August 2011



Plate 151: Quadrat IOH71, April 2011



Plate 152: Quadrat IOH71, July/August 2011



Plate 153: Relevé IOH72r, April 2011 (facing east)



Plate 154: Relevé IOH72r, April 2011 (facing west)



Plate 155: Relevé IOH72r, July/August 2011 (facing east)



Plate 156: Relevé IOH72r, July/August 2011 (facing west)



Plate 157: Quadrat IOH73, April 2011



Plate 158: Quadrat IOH73, July/August 2011



Plate 159: Quadrat IOH75, April 2011



Plate 160: Quadrat IOH75, July/August 2011



Plate 161: Quadrat IOH77, April 2011



Plate 162: Quadrat IOH77, July/August 2011

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Appendix M: Site by Species Matrix

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Species	IOH01	IOH02	IOH03	IOH04	IOH05	IOH06	IOH07	IOH08	IOH09	IOH10	IOH11r	IOH12	IOH13	IOH14	IOH15	IOH16	IOH17	IOH18	IOH19	IOH20	IOH21	IOH22	IOH23	IOH24	IOH25	IOH26	IOH27	
<i>Abutilon dioicum</i>	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Abutilon leucopetalum</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Abutilon otocarpum</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Abutilon trudgenii</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Acacia adoxa</i> var. <i>adoxo</i>	0	1	1	0	1	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	0
<i>Acacia adsurgens</i>	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Acacia ancistrocarpa</i>	0	0	1	0	0	0	1	1	1	0	1	1	1	1	0	0	0	1	0	1	1	0	0	1	1	0	1	0
<i>Acacia arida</i>	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Acacia bivenosa</i>	1	1	0	0	1	0	1	1	1	1	0	1	0	1	1	1	1	1	0	1	1	1	1	0	1	0	1	0
<i>Acacia citrinoviridis</i>	0	0	0	0	0	0	0	1	1	1	0	0	1	0	0	0	0	0	1	1	1	1	0	0	1	0	1	0
<i>Acacia dictyophleba</i>	0	0	0	1	0	0	0	0	1	1	1	0	1	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0
<i>Acacia hilliana</i>	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	1	1	0	1	1	0	0	0	1	1	1	1
<i>Acacia holosericea</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Acacia inaequilatera</i>	0	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	0	1	0	1	0
<i>Acacia maitlandii</i>	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
<i>Acacia monticola</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
<i>Acacia pachyacra</i>	0	0	0	1	1	0	0	0	0	1	1	0	1	0	0	0	0	0	0	1	0	1	1	1	1	0	1	0
<i>Acacia pruinocarpa</i>	0	0	0	1	0	0	0	1	0	0	0	1	0	1	0	1	0	0	0	0	0	1	0	0	0	0	1	0
<i>Acacia pyrifolia</i>	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	1	0	0	0	0
<i>Acacia spondylophylla</i>	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
<i>Acacia tumida</i>	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0
<i>Amphipogon sericeus</i>	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	0	0	0	0	0	0
<i>Aristida contorta</i>	0	1	0	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0
<i>Aristida holathera</i> var. <i>holathera</i>	0	1	1	1	1	1	0	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	0	0	1
<i>Aristida inaequiglumis</i>	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
<i>Atalaya hemiglauca</i>	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
<i>Boerhavia coccinea</i>	1	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
<i>Bonamia erecta</i>	0	0	0	0	1	0	1	1	1	0	1	0	1	0	0	0	0	1	1	1	0	0	0	1	0	0	0	0
<i>Bonamia media</i> var. <i>villosa</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0
<i>Bonamia rosea</i>	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
<i>Calytrix carinata</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1	1
<i>Cenchrus ciliaris</i>	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
<i>Cenchrus setiger</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Chrysopogon fallax</i>	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
<i>Clerodendrum floribundum</i>	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Corchorus crozophorifolius</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Corchorus lasiocarpus</i>	0	0	0	1	0	0	1	0	1	1	0	0	0	0	0	1	1	0	1	1	1	1	1	1	0	1	1	1
<i>Corchorus tectus</i>	0	0	1	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
<i>Corchorus tridens</i>	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Corymbia deserticola</i>	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Corymbia hamersleyana</i>	0	1	1	1	1	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	0
<i>Corymbia opaca</i>	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Crotalaria medicaginea</i> var. <i>neglecta</i>	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Cucumis maderaspatanus</i>	0	0	1	0	1	0	0	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
<i>Cullen lachnostachys</i>	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Cymbopogon ambiguus</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Cymbopogon obtectus</i>	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
<i>Dampiera candidans</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
<i>Dicrastylis cordifolia</i>	0	1	0	0	1	0	1	1	1	0	1	1	1	0	0	0	1	0	1	0	0	1	1	1	0	0	1	0
<i>Dodonaea coriacea</i>	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	1	1	0	1	0	1	0	0	0	0	0	0	0
<i>Duperreya commixta</i>	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
<i>Enneapogon lindleyanus</i>	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Enneapogon polyphyllus</i>	0	0	0	0	1	1	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0
<i>Eragrostis cumingii</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
<i>Eragrostis eriopoda</i>	0	0	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	1	0	0	1	1	0	1	0
<i>Eremophila longifolia</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
<i>Eriachne aristidea</i>	1	0	1	0	1	1	1	1	1	0	1	0	1	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0
<i>Eriachne lanata</i>	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	1	0	0
<i>Eriachne mucronata</i>	0	1	0	0	0	1	1	0	0	1	0	1	0	1	1	1	0	0	0	1	1	0	0	1	0	0	1	1
<i>Eriachne tenuiculmis</i>	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Eucalyptus gamophylla</i>	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	0	0	0	0	0	1	0	0	0	1	0	0	0	1	1	1	0	1	0	0	1	1	0	0	0	1	1	0
<i>Eulalia aurea</i>	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Euphorbia australis</i>	0	0	1	1	1	0	1	1	1	0	1	1	1	1	0	0	0	1	1	1	1	0	0	1	1	0	0	0
<i>Euphorbia boophthona</i>	0	0	0	1																								

[illegible]

Species	IOH28	IOH29r	IOH30	IOH31	IOH32	IOH33	IOH34	IOH35	IOH36	IOH37	IOH38	IOH39r	IOH40	IOH41	IOH42	IOH43	IOH44	IOH45	IOH46	IOH47	IOH48	IOH49	IOH50	IOH51	IOH52	IOH53	IOH54	
<i>Abutilon dioicum</i>	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
<i>Abutilon leucopetalum</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	
<i>Abutilon otocarpum</i>	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	
<i>Abutilon trudgenii</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Acacia adoxa</i> var. <i>adoxo</i>	0	0	1	0	1	0	1	0	0	0	1	0	1	0	0	0	1	1	1	0	0	1	1	1	1	1	1	
<i>Acacia adsurgens</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Acacia ancistrocarpa</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	
<i>Acacia arida</i>	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Acacia bivenosa</i>	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	1	1	1	0	1	1	
<i>Acacia citrinoviridis</i>	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	
<i>Acacia dictyophleba</i>	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	
<i>Acacia hilliana</i>	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	1	0	1	0	1	
<i>Acacia holosericea</i>	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
<i>Acacia inaequilatera</i>	1	0	0	0	1	0	0	0	1	1	0	0	1	0	1	1	1	1	1	1	1	0	1	1	1	1	0	1
<i>Acacia maitlandii</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	
<i>Acacia monticola</i>	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Acacia pachyacra</i>	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	1	
<i>Acacia pruinocarpa</i>	1	0	0	1	0	0	1	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	1	
<i>Acacia pyrifolia</i>	0	1	1	1	1	1	0	1	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Acacia spondylophylla</i>	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	
<i>Acacia tumida</i>	1	1	0	1	0	1	0	1	1	1	0	1	0	1	1	0	0	0	0	0	0	0	1	0	1	0	1	
<i>Amphipogon sericeus</i>	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	1	1	1	1	0	1	0	
<i>Aristida contorta</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	
<i>Aristida holathera</i> var. <i>holathera</i>	1	0	1	0	1	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	
<i>Aristida inaequiglumis</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	
<i>Atalaya hemiglauca</i>	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Boerhavia coccinea</i>	0	1	0	0	0	1	0	1	1	1	0	1	0	1	1	0	0	0	1	0	0	0	0	0	0	0	1	
<i>Bonamia erecta</i>	1	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	1	0	0	1	0	1	0	0	1	
<i>Bonamia media</i> var. <i>villosa</i>	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	1	1	0	0	0	
<i>Bonamia rosea</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Calytrix carinata</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	
<i>Cenchrus ciliaris</i>	0	0	0	0	0	1	0	1	1	1	0	1	0	1	1	0	0	0	1	1	0	0	0	0	0	0	1	
<i>Cenchrus setiger</i>	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Chrysopogon fallax</i>	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Clerodendrum floribundum</i>	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Corchorus crozophorifolius</i>	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Corchorus lasiocarpus</i>	0	1	1	1	1	0	1	0	1	0	1	0	1	1	1	1	0	0	0	0	1	0	1	1	1	0	1	
<i>Corchorus tectus</i>	1	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	
<i>Corchorus tridens</i>	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Corymbia deserticola</i>	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	
<i>Corymbia hamersleyana</i>	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	
<i>Corymbia opaca</i>	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Crotalaria medicaginea</i> var. <i>neglecta</i>	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Cucumis maderaspatanus</i>	0	0	1	0	0	1	1	0	1	0	0	0	1	1	1	0	1	0	1	0	0	0	0	0	0	0	0	
<i>Cullen lachnostachys</i>	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Cymbopogon ambiguus</i>	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Cymbopogon obtectus</i>	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	
<i>Dampiera candidans</i>	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	
<i>Dicrastylis cordifolia</i>	1	0	1	0	1	0	0	0	1	0	0	0	1	0	1	0	1	0	1	0	1	0	1	0	1	1	1	
<i>Dodonaea coriacea</i>	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	1	0	0	0	0	
<i>Duperreya commixta</i>	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Enneapogon lindleyanus</i>	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Enneapogon polyphyllus</i>	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	
<i>Eragrostis cumingii</i>	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Eragrostis eriopoda</i>	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	1	0	1	0	0	0	1	
<i>Eremophila longifolia</i>	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	
<i>Eriachne aristidea</i>	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	1	0	0	0	0	
<i>Eriachne lanata</i>	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	
<i>Eriachne mucronata</i>	1	1	0	1	1	1	1	1	1	0	0	1	0	1	1	1	1	1	0	0	1	1	1	1	0	1	1	
<i>Eriachne tenuiculmis</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Eucalyptus gamophylla</i>	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	1	0	1	0	0	1	
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	0	0	1	1	0	0	1	0	0	0	0	0	1	0	0	1	1	1	0	0	0	0	0	0	1	0	0	
<i>Eulalia aurea</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
<i>Euphorbia australis</i>	1	0	0	0	0	0	0	1	1	1	0	1	0	1	1	0	0	0	1	0	1	1	0	1	0	0	1	
<i>Euphorbia boophthona</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
<i>Goodenia stobbsiana</i>	0																											

