5 Threatened flora

This section provides a detailed assessment of the presence and potential impacts of development on ten EPBC listed threatened flora species that occur within the Growth Centres. These flora species are Downy Wattle (*Acacia pubescens)*, *Cynanchum elegans, Darwinia biflora, Dillwynia tenuifolia,* Small-flowered Grevillea *(Grevillea parviflora* subsp. *Parviflora), Micromyrtus minutiflora, Persoonia hirsuta, Persoonia nutans, Pimelea spicata* and *Pultenaea parviflora.*

The analysis provided for each species considers the following:

- relevant background information on the species, including known distribution, habitat requirements and level of existing reservation (if known);
- known and likely presence of the species within the Growth Centres and the importance of these areas to the species' conservation;
- potential impacts to known and likely areas supporting the species as a result of development within the Growth Centres;
- proposed strategies to mitigate and manage any potential impacts;
- proposed measures to offset any residual impacts to the species; and
- the conservation or net outcome for the species.

INFORMATION BASE

The information that has been used to inform this assessment has come from a variety of sources. Relevant species profiles, recovery plans and scientific journal articles have provided background information on each species. The key resource used to provide information on species known presence within the Growth Centres was the NSW Wildlife Atlas (the Atlas), as well as any ecological survey reports prepared as part of the detailed precinct planning of the Program.

The Atlas is a database of flora and fauna records across NSW. It currently holds over 4 million records and is managed and maintained by DECCW. Atlas records come from a variety of sources and can be of varying levels of reliability. The records used in this project were audited by DECCW to ensure that low reliability records were not used. Records that were excluded included:

- Pre-1985 records.
- Duplicate records.
- Records with a stated accuracy >100m except where the site description provided enabled the actual site location to be determined.
- Records with a stated accuracy <100m if the site description did not match the grid references provided.
- Records where more recent targeted survey has definitively determined that the species is no longer present within the area.

Given that the Cumberland Plain has been the subject of extensive ecological investigation over the years, it is considered that the Atlas records provide a strong (if not complete) indication of the potential importance of the Growth Centres for threatened species. It is recognised however that as

comprehensive targeted surveys have not been undertaken, areas of the Growth Centres that have not been surveyed may provide habitat for threatened species.

In order to supplement the Atlas information, discussions with flora species experts provided the opportunity to undertake a risk based approach to identifying potentially important areas within the Growth Centres that had not been identified through the Atlas records. There is a wealth of unpublished information available through academics, consultants and DECCW staff. Relevant experts were consulted to supplement the published information, where possible.

While comprehensive site by site information is not available for the Growth Centres, it is considered that the approach as described above is adequate for a landscape scale assessment of the potential impacts to threatened species.

Note that all of the figures showing the location of Atlas records for each species display *every* record contained in the Atlas database at the time the analysis was undertaken (November 2009).

While it was important to audit the database to locate reliably recorded sites for the purpose of confirming presence within specific boundaries of the Growth Centres, the records in their entirety are thought to provide a good representation of the broad-scale distribution for each species.

For this reason, records deemed unreliable through the audit process are excluded from the impact assessment discussion; however, they have not been excluded from illustration.

REFERENCE TO VEGETATION TYPES

Throughout this section reference is made to the vegetation types described in Tozer 2003 and commonly used in NSW. These vegetation types offer a useful level of detail for issues such as the discussion of habitat for threatened flora.

The Tozer vegetation types are typically sub-components of EPBC Act listed threatened ecological communities (discussed in the previous section) but should not be confused with matters protected by the EPBC Act. For example, the EPBC Act listed Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest comprises three Tozer vegetation types:

- Shale Plains Woodland;
- Shale Hills Woodland; and
- Shale Gravel Transition Forest.

5.1 ACACIA PUBESCENS

5.1.1 SPECIES DESCRIPTION

Acacia pubescens is a spreading to slightly weeping shrub, which grows up to 5 m tall and has golden yellow flowers. It is listed as vulnerable under both the Commonwealth EPBC Act and the NSW TSC Act.

A. pubescens is confined to the Sydney district, with most occurrences on the Cumberland Plain. The National Recovery Plan describes the core known distribution of *A. pubescens* as occurring to the east of the Growth Centres around the Bankstown – Fairfield – Rookwood area and the Pitt Town area; although, it is also known to occur in a number of other local government areas, including Auburn, Blacktown, Canterbury, Hawkesbury, Hills Shire, Holroyd, Liverpool, Parramatta, Rockdale, Strathfield, Sutherland and Wollondilly. A total of 116 populations across 151 sites are currently known to exist (with any plants within 300 m classified as part of the one population). It is estimated that over 90% of the original distribution of the species has been cleared (NPWS 2003a).

A. pubescens occurs on alluviums, shales and at the intergrade between shales and sandstones. Habitat for the species includes woodland and forest, in a variety of plant communities, including Alluvial Woodland, Cooks River/Castlereagh Ironbark Forest, Castlereagh Scribbly Gum Woodland, Shale/Gravel Transition Forest, Shale Hills Woodland, Shale Plains Woodland and Shale/Sandstone Transition Forest (DECC 2005m).

Most of the recruitment for *A. pubescens* occurs from vegetative reproduction and genetic studies have shown that a number plants over a large area (e.g. 1 ha) may be one individual plant (NPWS 2003a). Therefore, the significance of sites cannot be determined solely on the number of stems. Rather factors such as seed set, which may only occur in good seasons (Benson & McDougall 1996), size, quality and connectivity of habitat; site security and how close the site is to the species range boundary should be considered (NPWS 2003b). Fragmentation is considered a significant issue for this species particularly given the highly fragmented nature of existing habitat. NPWS (2003b) recommend that management of *A. pubescens* should aim to maintain habitat continuity between individuals within populations and avoid creating new sub-populations.

A. pubescens is currently conserved at four sites in Scheyville National Park, two sites in Prospect Nature Reserve and at one site in Windsor Downs Nature Reserve. Four other sites at Mountain Lagoon, Pleasure Point, Campbell Hill Pioneer Park and Duck River Reserve are on lands zoned for environmental protection. Around 62% of sites are in other forms of public ownership, and some of these are being managed for conservation purposes.

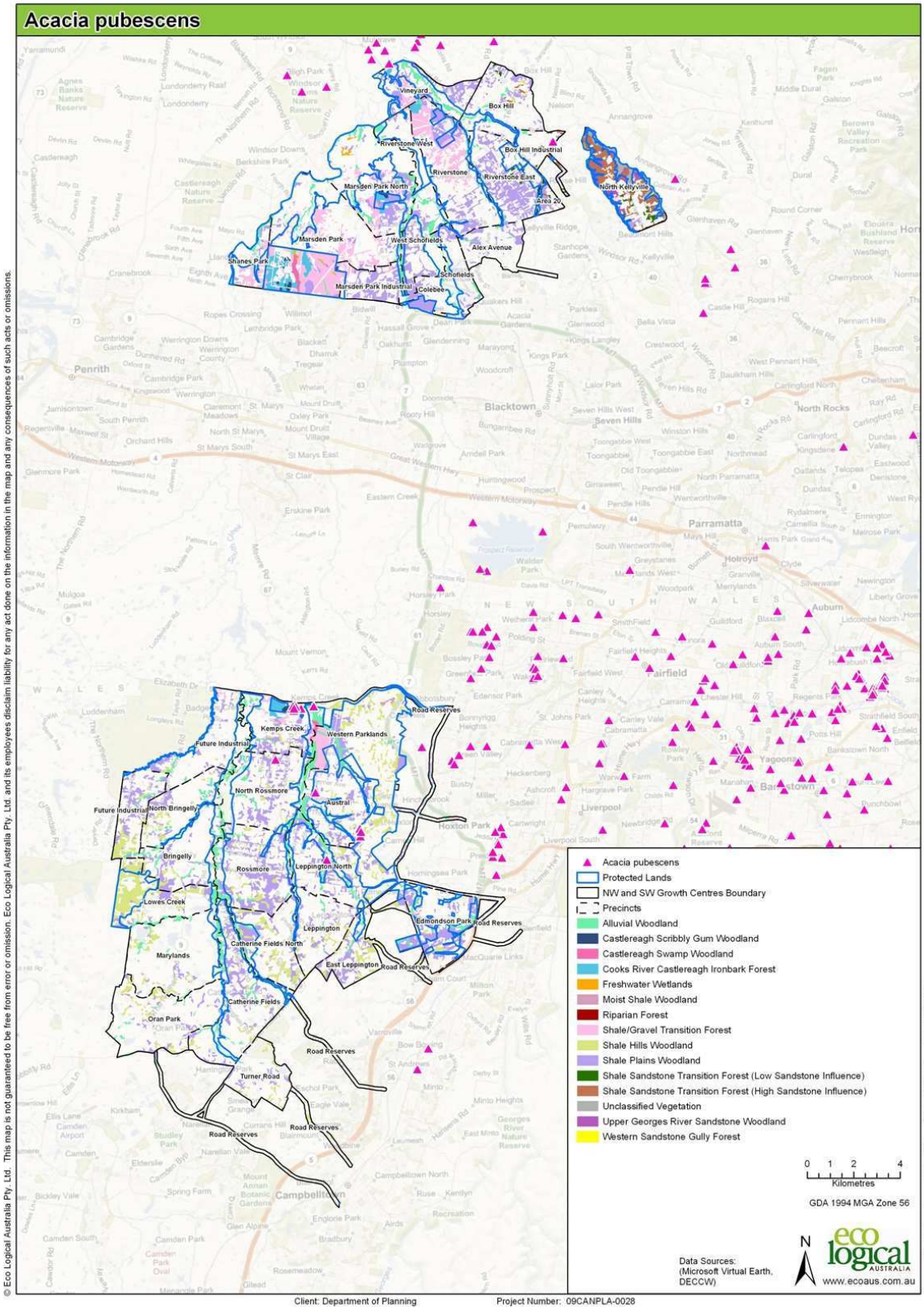

Figure 42: Species distribution and location of NSW Wildlife Atlas records for *Acacia pubescens* within and immediately surrounding the Growth Centres

5.1.2 *ACACIA PUBESCENS* WITHIN THE GROWTH CENTRES

The NSW Wildlife Atlas records for *A. pubescens* within and around the Growth Centres are shown in Figure 42. While there are a number of records within the Growth Centres, only two are considered to be reliable. Both of these occur within the South West Growth Centre.

One site (plant numbers not recorded) is located on a Sydney Water easement on the south-eastern boundary of the Austral Precinct. The second site of 4 to 5 plants is located within the Kemps Creek Precinct (see Figure 46). The remnant bushland at Kemps Creek has been identified as a site of particular conservation significance for the species (DEWHA 2009o).

Given that *A. pubescens* is generally found within the vegetation communities that make up the majority of remaining vegetation on the Cumberland Plain, it is considered possible that potential habitat for the species may occur across various areas of the Growth Centres. As a result, the Atlas records for this species are not considered to provide a strong representation of its potential occurrence within the Growth Centres.

The key potential habitat areas within the North West Growth Centre are thought to be associated with the plant communities of Shale Hills Woodland and Shale Gravel Transition Forest (pers comm. Teresa James, 19 March 2010). Within the South West Growth Centre, key potential habitat areas are thought to be associated with Shale Gravel Transition forest, and Shale Plains Woodland (containing Spotted Gum) (pers comm. Teresa James, 19 March 2010). These vegetation types are present throughout both Growth Centres and it is considered possible that the species may occur in areas of remnant vegetation that have not been surveyed.

While this potential exists, it is also recognised that the potential for the species to occur broadly within the Growth Centres is limited by the fact that:

- the core distribution for the species is known to occur outside of the Growth Centres; and
- the proportion of known *A. pubescens* records within the Growth Centres is low. It is estimated that there are currently a total of 116 populations in the Western Sydney region (NPWS 2003a), of which two reliable records are located in the Growth Centres.

5.1.3 POTENTIAL IMPACTS TO *ACACIA PUBESCENS* AS A RESULT OF DEVELOPMENT WITHIN THE GROWTH CENTRES

The two known populations of *A. pubescens* within the Growth Centres occur within non-certified areas in the South West Growth Centre. The Relevant Biodiversity Measures require that both of these sites be surveyed at the precinct planning, and if the species is confirmed to be present an area of suitable habitat must be protected to the satisfaction of DECCW. It is considered that potential impacts to these populations will be avoided based on the implementation of the Relevant Biodiversity Measures.

Potential impacts to the species in other areas of the Growth Centres on the other hand are difficult to estimate. Given that the Atlas records do not provide a complete distribution of potential habitat and that suitable vegetation types are present within areas to be developed, some level of impact (which cannot be quantified) from development within the Growth Centres may occur.

Again, the scale of these potential impacts is considered to be moderated to an extent by the location of the Growth Centres outside of the core area for the species.

5.1.4 PROPOSED MEASURES TO PREVENT, MITIGATE AND MANAGE POTENTIAL IMPACTS TO *ACACIA PUBESCENS*

The key mechanism for avoiding impacts to the known populations of *A. pubescens* within the Growth Centres is the implementation of the Relevant Biodiversity Measures for the Kemps Creek and Austral sites.

In relation to potential habitat, it is considered that other mechanisms within the Program have the potential to provide a benefit to the species. Given that the key vegetation types for the species within the Growth Centres (Shale Hills Woodland, Shale Plains Woodland and Shale Gravel Transition Forest) are components of EPBC listed Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest, it is considered likely that mechanisms that will provide a benefit for the ecological community may also benefit *A. pubescens*. As is the case for potential impacts, these potential benefits cannot be quantified.

The mechanisms relate to the protection of native vegetation and include:

- the retention and protection of existing native vegetation (minimum of 2,000 ha) within the Growth Centres; and
- the more specific protection and management of conservation areas (such as the Kemps Creek Nature Reserve).

As discussed in section 4.2, these two mechanisms will result in the protection of 710 ha of High and Moderate Management Viability Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest within the Growth Centres. While the presence of *A. pubescens* within these areas is unknown, they will incorporate areas of potential habitat for the species which will be retained and in relation to the conservation areas, actively managed.

It is considered that the measures to protect the known sites will provide appropriate protection for those populations, and that broader conservation measures within the Growth Centres are likely to provide some level of protection for the species. However, it is also recognised that impacts to potential habitat (outside of the core population of the species) are possible.

5.1.5 PROPOSAL TO OFFSET POTENTIAL IMPACTS TO *ACACIA PUBESCENS*

Due to the likely residual impacts to *A. pubescens*, offsets for this species within the Cumberland Plain are considered to be appropriate. Offsets have the potential to provide a significant long term benefit by increasing the number of known sites in conservation areas. At present, only a few known sites occur within conservation reserves and the recovery plan for the species identifies the addition of further sites as a key priority (NPWS 2003a).

The Program provides for a $530 million biodiversity offsets package to protect high conservation value areas both within and outside the Growth Centres. 70% of $397.5 million (in 2005/06 dollars) will be prioritised to secure high quality vegetation remnants with similar ecological values outside the Growth Centres with a particular focus on the conservation of matters of national environmental significance. As a first preference, these funds will be directed towards identified priority lands across the Cumberland Plain. The NSW Government will ensure that a component of this funding is allocated to protect likely habitat for EPBC threatened flora, including offset areas for *A. pubescens.*

5.1.6 CONSERVATION OUTCOME FOR *ACACIA PUBESCENS*

While the Growth Centres occur outside the core distribution of *A. pubescens*, both known and potential habitat for the species occur within the area. Potential habitat is linked to the presence of Shale Hills

Woodland, Shale Plains Woodland and Shale Gravel Transition Forest (components of EPBC listed Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest).

The Program provides for the protection of the two known sites within the South West Growth Centre. However, some level of impact (which cannot be quantified) to potential habitat within the Growth Centres is considered likely to occur. The scale of these potential impacts is considered to be moderated by:

- the location of the Growth Centres outside of the core area for the species; and
- the mechanisms in the Program that will protect native vegetation (which includes potential habitat for the species) within the Growth Centres.

Given that some level of residual impact is possible, offsets that increase the number of known sites of *A. pubescens* in conservation are considered to be appropriate. Based on the protection of known records and areas of potential habitat within the Growth Centres, as well as the allocation of offset funding to protect likely habitat for *A. pubescens*, the conservation outcome for the species is considered to be appropriate.

CONSISTENCY WITH THE APPROVED RECOVERY PLAN FOR ACACIA PUBESCENS

There is currently an approved recovery plan for *A. pubescens* which was prepared in accordance with the NSW TSC Act and the EPBC Act (NPWS 2003a).

The conservation activities and outcomes for this species that will occur as a consequence of the Program are not inconsistent with this recovery plan. The Program will help achieve one of the recovery objectives of the Plan, which is to: *"to ensure that a representative sample of A. pubescens populations occurring on public and private lands are protected from habitat loss and managed for conservation".*

5.2 CYNANCHUM ELEGANS

5.2.1 SPECIES DESCRIPTION

Cynanchum elegans is a climber with white tubular flowers and distinctive corky bark. It is listed as endangered under both the Commonwealth EPBC Act and the NSW TSC Act.

C. elegans is currently known to occur in 86 locations within NSW, where it is most commonly found within the Kempsey Region. Other locations include the Cumberland Plain, the Forster area, Manning Valley, Hunter Valley, Yabbra State Forest, Brunswick Heads, Illawarra, Gerroa, Merriwa and northeast of Tenterfield. It is estimated that the majority of known populations contain no more than 30 plants (DEWHA 2009p).

C. elegans occurs on the edges of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; Coastal Tea-tree *Leptospermum laevigatum* – Coastal Banksia *Banksia integrifolia* subsp. *integrifolia* coastal scrub; Forest Red Gum *Eucalyptus tereticornis* aligned open forest and woodland; Spotted Gum *Eucalyptus maculata* aligned open forest and woodland; and Bracelet Honeymyrtle *Melaleuca armillaris* scrub to open scrub (DEC 2005n). The species is subject to a number of threats, many of which are likely to occur in the Growth Centres. These include urban development and associated activities, weed invasion, changed hydrology associated with urban runoff, vandalism, erosion, land fill, rubbish dumping, pollution, human disturbance, and road/track widening (DEC 2005n).

C. elegans habitat has been fragmented by vegetation clearance for agriculture, urban development and quarrying across its range. The distance between populations of *C. elegans* that will create genetic isolation is unknown as the species' pollen vectors and the distance that its wind-dispersed seed is capable of travelling is unknown. NPWS (2002d) regards the clearing of interconnected or proximate areas of habitat for the species (or its pollen/seed vectors) as undesirable as this may expose populations to an increased risk of genetic isolation and subsequent decline. Its response to fire is unknown, but may possibly re-sprout (Benson and McDougall 1993).

Around 14% of known occurrences of *C. elegans* are protected across NSW. In the Illawarra region, the species is conserved at the Illawarra Escarpment State Conservation Area and Berkeley Islands Nature Reserve; in the Sydney region, it is conserved at Wollemi National Park, the Western Sydney Parklands and Goulburn River National Park; and in northern NSW it is conserved at Booti Booti National Park Brunswick Heads Nature Reserve, Camels Hump Nature Reserve, Hat Head National Park, Torrington State Recreation Area, Glenrock State Recreation Area, Green Point Reserve, and Woko National Park.

5.2.2 *CYNANCHUM ELEGANS* WITHIN THE GROWTH CENTRES

There is one NSW Wildlife Atlas record for *C. elegans* in the South West Growth Centre (NSW Wildlife Atlas 2009). However analysis has shown that the location of this record is incorrect. The coordinates locate this record on a large rural property adjacent to a creek on a horse stud farm. However, the site description for this record is inconsistent with these coordinates and confirms that the site is actually located outside of the Growth Centres at Cobbitty

The species is not known to occur within the North West Growth Centre and there is limited potential habitat for the species there.

This lack of records across the Growth Centres reflects a lack of generally suitable habitat for the species. As a result, there is very limited potential for the species to occur in unsurveyed areas within

the Growth Centres. The species is most commonly found within the Kempsey region along the northern coast of NSW and is known to occur in 85 locations outside the Growth Centres. There are several records of the species to the west of the South West Growth Centre.

5.2.3 POTENTIAL IMPACTS TO *CYNANCHUM ELEGANS* AS A RESULT OF DEVELOPMENT WITHIN THE GROWTH CENTRES

No sites containing this species are recorded within the Growth Centres and there is limited potential for the species to occur in other areas of the Growth Centres due to a lack of generally suitable habitat. Therefore, there are not expected to be any impacts to this species as a result of development within the Growth Centres. As such, mitigation and offset measures targeting *Cynanchum elegans* are not considered necessary.

5.3 DARWINIA BIFLORA

5.3.1 SPECIES DESCRIPTION

Darwinia biflora is an erect to spreading shrub that grows up to 80 cm high, with white to green tubular flowers when young, turning red and usually paired. It is listed as vulnerable under both the Commonwealth EPBC Act and the NSW TSC Act.

D. biflora has a restricted distribution and is only found in the northern and north-western suburbs of Sydney, in the Ryde, Hills Shire, Hornsby and Ku-ring-gai local government areas. The Recovery Plan for *D. biflora* identifies 241 sites where the species currently occurs, and these sites consist of 105 populations. The definition of a population was determined by 500 m dispersal ranges that did, at times, contain more than one site (DEWHA 2009q).

D. biflora is a ridge top species occurring within habitat areas where the weathered shale-capped ridges integrade with Hawkesbury Sandstone. Vegetation communities associated with these soil types typically consist of Sandstone Ridge Top Woodlands (DEWHA 2009q). The distribution of this species overlaps with the EPBC listed ecological community, Shale Sandstone Transition Forest, which is found within the Growth Centres (DEWHA 2009q). *D. biflora* often inhabits the gentle slopes near the crests of ridges or on sheet rock with moss beds. The largest and most significant areas of habitat occur around the North Turramurra and North Wahroonga areas (NPWS 2003c).

Fire is one of the most important factors affecting the viability of *D. biflora* populations (DEC 2004). Too frequent fires will impede the development of an adequate seedbank. If fire is suppressed for too long (>20 years), the number of adults in the population will decline. This species can be quite tolerant of occasional disturbances, such as fire or slashing, however, may not survive intensive weed invasion (NPWS 2003c). Fragmentation is a significant issue in the west of the species' range (particularly in the Hills Shire), where sites generally have low population numbers (NPWS 2003c).

According to the Recovery Plan for *D. biflora* (DEC 2004), there are two types of land tenure containing the species that are managed primarily for conservation: National Park land covering 21% of known sites (51 sites); and the Berowra Valley Regional Park, which contains 16% of total known sites (39 sites). The Recovery Plan also notes that much of the reserved areas are in the south and the east of the distribution range while much of the northern and western sites are under development pressure.

5.3.2 *DARWINIA BIFLORA* WITHIN THE GROWTH CENTRES

Known and potential habitat for *D. biflora* within the Growth Centres occurs in the North Kellyville Precinct. This precinct has been re-zoned under the Growth Centres SEPP.

In accordance with the Relevant Biodiversity Measures, the non-certified area within North Kellyville was subject to on-ground survey at the precinct planning stage to confirm the presence and extent of populations of *D. biflora.* The populations of *D. biflora* confirmed to be present within this area were required to be protected to the satisfaction of DECCW. As North Kellyville has already undergone detailed precinct planning, the following description and analysis of species presence is based on two sources of information: the NSW Wildlife Atlas records and the on-ground survey information obtained for the non-certified area near Heath Road.

There are numerous NSW Wildlife Atlas records for *D. biflora* within the Growth Centres. All of these records occur within the North Kellyville Precinct in the North West Growth Centre (see Figure 43) at the following sites:

- Hill View Road containing 10 plants;
- off 27 Foxall Road containing over 1000 plants;
- a site at the intersection of Heath Road and Foxall Road (15 plants recorded at original site. 18 records (total of 70 plants) were submitted in 2008 (after the preparation of the recovery plan) for locations within approx. 200 m of the original record);
- near Heath and Foxall Road containing three plants;
- adjacent to 38 Stringers Road (no plant numbers recorded);
- two sites, along road reserve adjacent to 38 Stringers Road (no plant numbers recorded);
- along the eastern side of Lot 187 containing over 200 plants;
- along the western side of Lot 187 containing over 4000 plants;
- along the southern section of Lot 188 containing over 200 plants;
- along the northern section of Lot 188 (no plant numbers recorded); and
- east of Stringer Road containing over 100 plants.

Three populations in the North Kellyville area, but outside of the Growth Centres, are identified in the species' Recovery Plan as being of high significance for conservation (DEC 2004a). These populations are: Kellyville at Heath Road, Kellyville near Cattai Creek and Kellyville Roseberry Rd around Cattai Creek.

In accordance with the Relevant Biodiversity Measures, on-ground survey of the non-certified area was undertaken to confirm the presence and extent of populations of *D. biflora*. The results of this survey are shown in Figure 44. The large, central area of known habitat is expected to contain between 5,000 to 10,000 plants, although the area may potentially support up to 20,000 plants. The area of known and potential habitat to the west of this central area is expected to support a lower density of plants; roughly estimated to be between 1,000 to 2,000 plants, and linked to a smaller secondary known area of between 100 to 200 plants. To the east of the central area, habitat is limited with one known area containing between 50 to 100 plants.

It is important to note that the information obtained through the survey of the non-certified area is both consistent and supplementary to existing Atlas records. This means that the population estimates from the survey are not entirely additional to the estimates provided through the Atlas records, as a number of the Atlas records represent the same populations identified through the survey. For example, the Atlas record along the western side of Lot 187 containing over 4000 plants is actually a record for the known habitat area confirmed through survey to support up to 10,000 plants.

While targeted surveys have not been undertaken throughout the remainder of the Growth Centres, the NSW Wildlife Atlas records for the species appear to adequately reflect the key or important areas of habitat. Throughout the Growth Centres, there is limited potential for the species to occur in areas outside of these known records. The key habitat for *D. biflora* is associated with the vegetation community of Sandstone Ridge-top Woodland/heath, with marginal habitat occurring in areas with Shale Sandstone Transition Forest (with a high sandstone influence) and Sydney Sandstone Gully Forest (pers comm. Teresa James, 19 March 2010). Within the Growth Centres, these habitats are mainly found within and around the North Kellyville Precinct. This Precinct was surveyed as part of the detailed precinct planning. The potential for additional important areas to be identified is considered to be limited.

In a regional context, the populations of *D. biflora* within the North West Growth Centre are considered to be important. The Recovery Plan discusses the largest populations as those that have greater than 5000 recorded individuals (DEC 2004a). The known habitat area is expected to support a population of this size or greater. There are a number of additional records of sizable populations within the area containing plant numbers well above the species' median population size of 50.

The Recovery Plan also notes that population size should not be used as a sole indicator of the significance of a site, since numbers of individuals at a site vary substantially with time since fire. Other factors, such as area of available habitat, quality of habitat and whether the site is at the edge of the species range are also important (DEC 2004a). The populations of *D. biflora* at North Kellyville are likely to be significant in this context as the area represents the western edge of this species range and in this region the populations are at significant threat from fragmentation (NPWS 2003c).

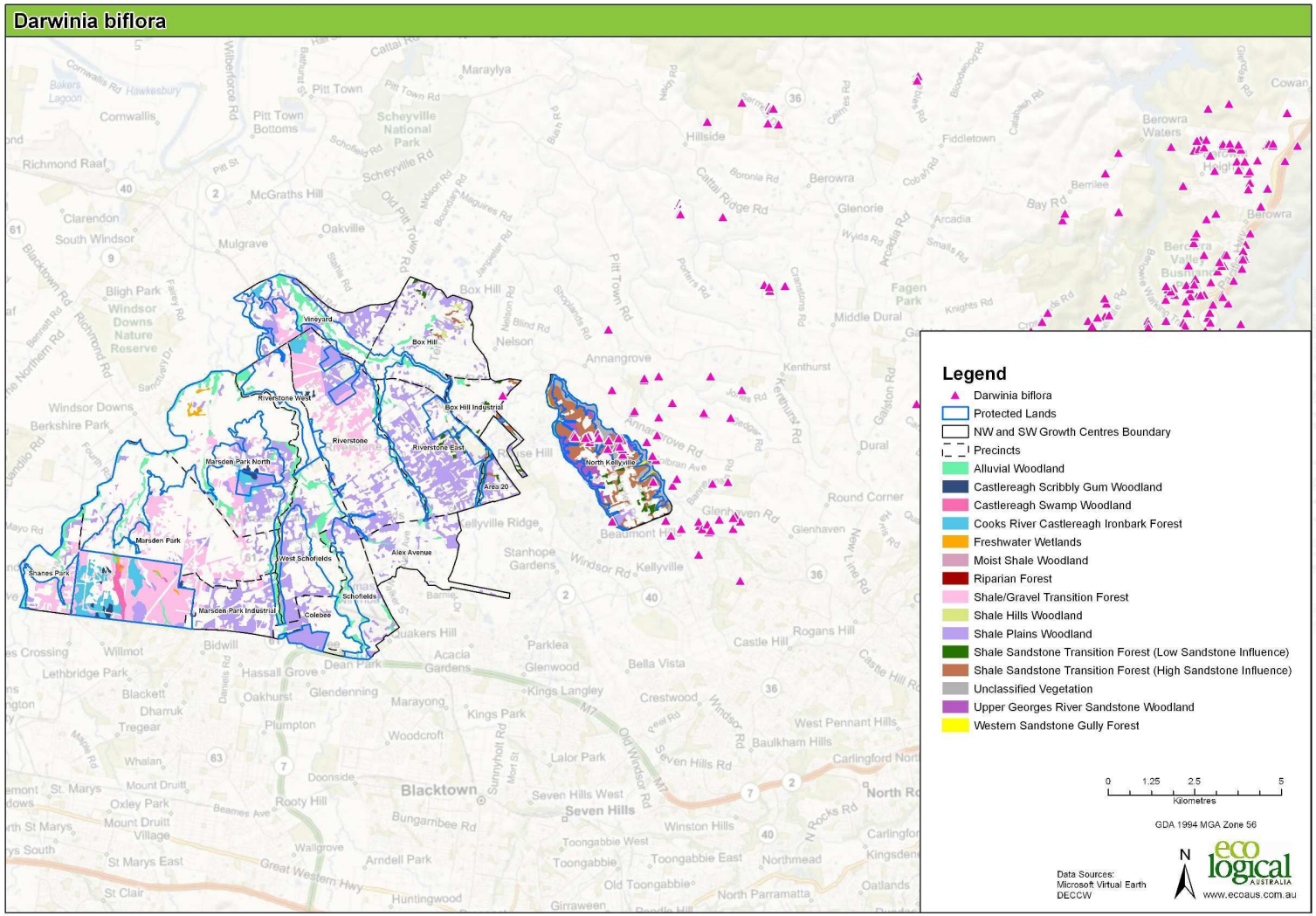

Figure 43: Species distribution and location of NSW Wildlife Atlas records for *Darwinia biflora* within and immediately surrounding North Kellyville within the North West Growth Centre

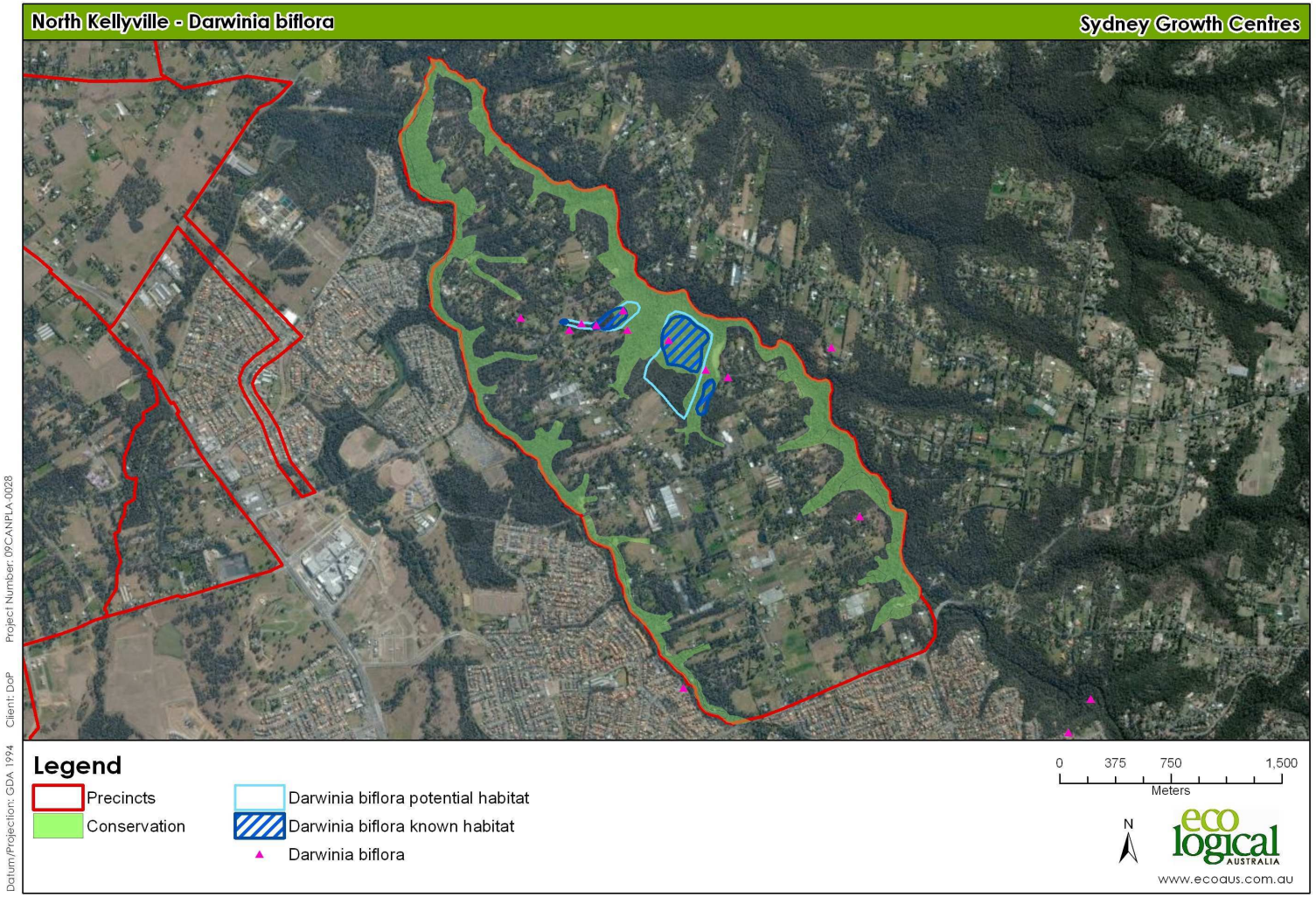

Figure 44: Results of the survey for populations of *D. biflora* within the non-certified area of North Kellyville.

NB: The records of *D. biflora* shown in this figure show the location of the sites identified in the recovery plan for the species.

5.3.3 POTENTIAL IMPACTS TO *DARWINIA BIFLORA* AS A RESULT OF DEVELOPMENT WITHIN THE GROWTH CENTRES

Within the Growth Centres, the following direct impacts to *D. biflora* are expected:

- loss of the Atlas record east of Stringers Road recorded as over 100 plants and the two records near Stringers Road with unknown plant numbers. The location of these records is consistent with the western corridor of known and potential habitat identified through the survey which suggests that the area of loss is likely to be greater than that reported through the Atlas database and may be up to 2,000 plants;
- loss of the Hill View Road record, containing 10 plants;
- loss of the record off 27 Foxall Road containing over 1000 plants;
- loss of the record at the intersection of Heath Road and Foxall Road (15 plants recorded at original site. 18 records (total of 70 plants) were submitted in 2008 (after the preparation of the recovery plan) for locations within approx. 200 m of the original record; and
- loss of the record near Heath and Foxall Road containing three plants.

Based on the on-ground survey undertaken within the non-certified area, the area to be retained contains over 75% of plants.

The area of known habitat for *D. biflora* that supports up to 10,000 plants will be retained through zoning as E3 Environmental Management. This zoning affords the species some protection, in accordance with one of its objectives to "*protect, manage and restore areas with special ecological, scientific, cultural or aesthetic values*". Indirect impacts to these populations from development within the Growth Centres will need to be considered and managed. In general, urban development has the potential to impact adjoining areas of bushland through various edge effects such as:

- the introduction of weeds and exotic species which can outcompete and displace individuals of *D. biflora*;
- the spread of rubbish;
- increased disturbance and trampling from pedestrian access and associated recreational activities;
- runoff from construction containing nutrients, sediments and other pollutants; and
- inappropriate water, sewer and stormwater management leading to erosion.

As it is unlikely that important populations of the species occur in areas that have not been surveyed within the Growth Centres, additional impacts to the species as a result of development are considered unlikely.

5.3.4 PROPOSED MEASURES TO PREVENT, MITIGATE AND MANAGE POTENTIAL IMPACTS TO *DARWINIA BIFLORA*

The key measure to prevent, mitigate and manage potential impacts to *D. biflora* is the retention of known habitat areas within the E3 Environmental Management zone. This zoning affords the species some protection, in accordance with one of its objectives to "*protect, manage and restore areas with special ecological, scientific, cultural or aesthetic values*". In addition, the consent authority must ensure that development will not result in the clearing of any native vegetation.

This area of known habitat is expected to contain at least 5,000 to 10,000 plants and has the potential to support up to 20,000 plants. Based on these population estimates, this area is considered important to the on-going preservation of the species. In the absence of conservation provisions afforded through the E3 Environmental Management zone, this habitat area would be under considerable pressure from future development.

Importantly, the National Recovery Plan for *D. biflora* acknowledges that sites in the north and west of the species' range are generally not conserved, and tend to be in areas that are under high levels of development pressure (DEC 2003). For this reason, the zoning outcome at North Kellyville is significant as it provides for the protection of an important population of *D. biflora* at the western edge of the species range.

5.3.5 PROPOSAL TO OFFSET POTENTIAL IMPACTS TO *DARWINIA BIFLORA*

It is considered likely that there will be residual impacts to *D. biflora* as a result of development within the Growth Centres. However, there is currently no opportunity to provide offsets for this species within the priority lands.

5.3.6 CONSERVATION OUTCOME FOR *DARWINIA BIFLORA*

The North West Growth Centre supports numerous known sites of *D. biflora* containing many thousands of recorded individuals. This area is considered to be important due to its occurrence in the western limit of the species distribution and the extent of habitat within the precinct and broader area. Outside of the Growth Centres, but still within Kellyville, three populations have been identified by the Recovery Plan (DEC 2003) as being of high conservation value.

An important area of known habitat supporting up to 10,000 plants will be retained through zoning as E3 Environmental Management. Protection of this area is considered to be important to the conservation of the species. The Recovery Plan acknowledges that although 37% of sites across the species' distribution are on land managed for conservation, these sites are concentrated in the south and east of the species' range (DEC 2003). Thus the genetic variation of populations in the north and west of the species' range are underrepresented in reserves. This outcome therefore provides an important contribution to the diversity in reserve populations.

There will be a number of losses in terms of known sites and population numbers. It is considered likely that there will be residual impacts to *D. biflora* as a result of development within the Growth Centres. However, there is currently no opportunity to provide offsets for this species within the priority lands.

CONSISTENCY WITH THE APPROVED RECOVERY PLAN FOR DARWINIA BIFLORA

There is currently an approved recovery plan for *D. biflora* which was prepared in accordance with the NSW TSC Act and the EPBC Act (DEC 2004).

The conservation activities and outcomes for this species that will occur as a consequence of the Program are not inconsistent with this recovery plan. The Program will help achieve one of the objectives of the Plan which is to: "*To ensure that a representative sample of D. biflora populations occurring on public and private lands are protected from habitat loss and managed for conservation."*

5.4 DILLWYNIA TENUIFOLIA

5.4.1 SPECIES DESCRIPTION

Dillwynia tenuifolia is a low spreading shrub to 1 metre tall with yellow flowers tinged red. It is listed as vulnerable under both the Commonwealth EPBC Act and the NSW TSC Act.

D. tenuifolia is endemic to the Sydney region. Its known distribution is limited to the Bulga Mountains at Yengo and South Maroota in the north, Woodford and Kurrajong Heights in the Blue Mountains in the west, Kemps Creek vicinity in the south and Deans Park in the east. The core habitat of the species is found on the Cumberland Plain, from Windsor to Penrith, and east to Deans Park. There are approximately 35 populations. These populations are locally disjunct, with several of the populations listed as endangered populations under the NSW TSC Act. A very large population also occurs on the Cranebrook site, located southwest of Castlereagh Nature Reserve. At this site, it is estimated that the population consists of 125,000 to 222,000 plants (Jones 2007). The Cranebrook site is now owned by the NSW Government and is proposed to be a reserve.

Overall, the species is not considered to be severely fragmented throughout the entire distribution (DEWHA 2009r).

The total population size for *D. tenuifolia* is estimated to be millions of individuals. Population numbers naturally fluctuate due to disturbance such as fire. The abundance of *D. tenuifolia* is influenced by past disturbance history which results in high population densities in areas opened up through disturbance (DECC 2005p). When the associated vegetation recovers from the disturbance, this species retreats to the soil seedbank with only a few emergent individuals present (NPWS 2002c).

The species typically occurs in habitat containing scrubby/dry heath and is associated with the vegetation communities of Castlereagh Ironbark Forest and Shale Gravel Transition Forest. The species has also been recorded in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland (DEC 2005p). A key factor in the abundance of the species within these habitats is the occurrence of fire. While fire kills above-ground individuals, the species is able to re-establish itself from soil-stored seed (DEC 2005p).

As with other plant species occurring within the Cumberland Plain, key threats to the distribution and abundance of *D. tenuifolia* include the clearance and fragmentation of habitat, inappropriate fire regimes, uncontrolled vehicular access, fill and rubbish dumping and weed invasion.

D. tenuifolia has been recorded in a number of conservation reserves including Scheyville National Park, Blue Mountains National Park, Yengo National Park, Wollemi National Park, Agnes Banks Nature Reserve, Windsor Downs Nature Reserve, Castlereagh Nature Reserve and Mulgoa Nature Reserve (DECC 2008a). However, the presence of *D. tenuifolia* within Yengo National Park and the Blue Mountains National Park has since been questioned (AVH 2008).

An analysis of all records for this species on the Cumberland Plain was undertaken as part of the preparation of the Draft Cumberland Plain Recovery Plan. For the purposes of the analysis, populations were delineated by geographic discontinuities of over 1km between reliable records and sites were delineated by geographic discontinuities of over 200m between reliable records. A total of 132 sites comprising 30 populations of *D. tenuifolia* were identified. Of these, 20 sites from four populations occur in formal conservation reserves. A further five sites from two populations occur on land that has been purchased for the purpose of reservation under the NP&W Act (these are the lands at Cranebrook and Colebee).

5.4.2 *DILLWYNIA TENUIFOLIA* WITHIN THE GROWTH CENTRES

There are numerous NSW Wildlife Atlas records for *Dillwynia tenuifolia* throughout the Growth Centres, as shown in Figure 45.

Within the North West Growth Centre there are four populations reliably recorded for *D. tenuifolia.* These include:

- one population of over 300 plants within the Riverstone Precinct (GHD 2008);
- one population of over 10,000 plants within the Marsden Park North Precinct;
- one population of over 5,000 plants within the non-certified area adjacent to the Colebee Precinct; and
- one population supported by numerous records within the Air Services Australia site at Shanes Park.

Within the South West Growth Centre there are a further four populations reliably recorded for *D. tenuifolia*. These include:

- one population of over 10,000 plants towards the northern boundary of the Kemps Creek Precinct;
- a second smaller population of around 100 plants within the Kemps Creek Precinct;
- one population (plant numbers unknown) within the North Rossmore Precinct; and
- one population (plants numbers unknown) within the Western Sydney Parklands.

The population towards the north of the Kemps Creek Precinct has been listed as an Endangered Population under Section 11 of the NSW TSC Act as the population is disjunct, occurs on unreserved land and is at the spatial limit of the known distribution of the species. This site has been estimated to contain between 10,000 and 219,000 individuals, although abundance and population structure are influenced by past localised disturbance history (NPWS 2002c).

The larger populations within the North West Growth Centre are also considered to be important for the species preservation due to their significant size and occurrence within intact habitat close to the south-eastern limit of the species distribution. The Urban Bushland Biodiversity Survey describes the Marsden Park North area as a site of core habitat for the species (NPWS 1997).

Within both the North West and the South West Growth Centres, key habitat for the species is associated with the vegetation communities of Shale Gravel Transition Forest and the Castlereagh communities, with marginal habitat occurring in particular occurrences of Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest (those areas with a localised occurrence of lateritic gravels) (pers comm. Teresa James, 19 March 2010). Within the North West Growth Centre, marginal habitat is also associated with areas of Shale Sandstone Transition Forest with lateritic gravels (pers comm. Teresa James, 19 March 2010).

While targeted surveys have not been undertaken throughout the Growth Centres, the NSW Wildlife Atlas records for the species appear to adequately identify the key or important habitat areas. In the South West Growth Centre, suitable habitat for *D. tenuifolia* is generally confined to the Kemps Creek region where there are localised occurrences of lateritic gravels and intact areas of Shale Gravel

Transition Forest, Castlereagh Scribbly Gum Woodland and Cooks River Castlereagh Ironbark Forest. As outlined above, a number of records exist for this area, including an important large population towards the north of the precinct. There is some potential for the species to occur in isolated areas within and around the Kemps Creek Precinct that have not been surveyed. However, the potential for additional important areas to be identified is considered to be limited.

In the North West Growth Centre, key areas of suitable habitat occur within the remnants of Shale Gravel Transition Forest at the Shanes Park Air Services Australia site, the Marsden Park North Precinct and the Riverstone Precinct; within the remnants of Castlereagh Scribbly Gum Woodland and Cooks River Castlereagh Ironbark Forest at the Shanes Park Air Services Australia site, the Marsden Park North Precinct, the Riverstone and Vineyard Precincts; and within an area (shown as Shale Plains Woodland on Figure 45) associated with lateritic gravel and patches of Tertiary alluvium adjacent to the Colebee Precinct (NPWS 1997). These areas are identified as known habitat through existing records in the NSW Wildlife Atlas for this species. Based on these habitat characteristics, there is some potential for the species to occur within areas around the Colebee/Schofields area and the north Riverstone/Vineyard area. However, as with the South West Growth Centre, the important areas for the species within the North West Growth Centre are thought to be well represented through the NSW Wildlife Atlas records and there is considered to be limited potential for additional important areas to be identified.

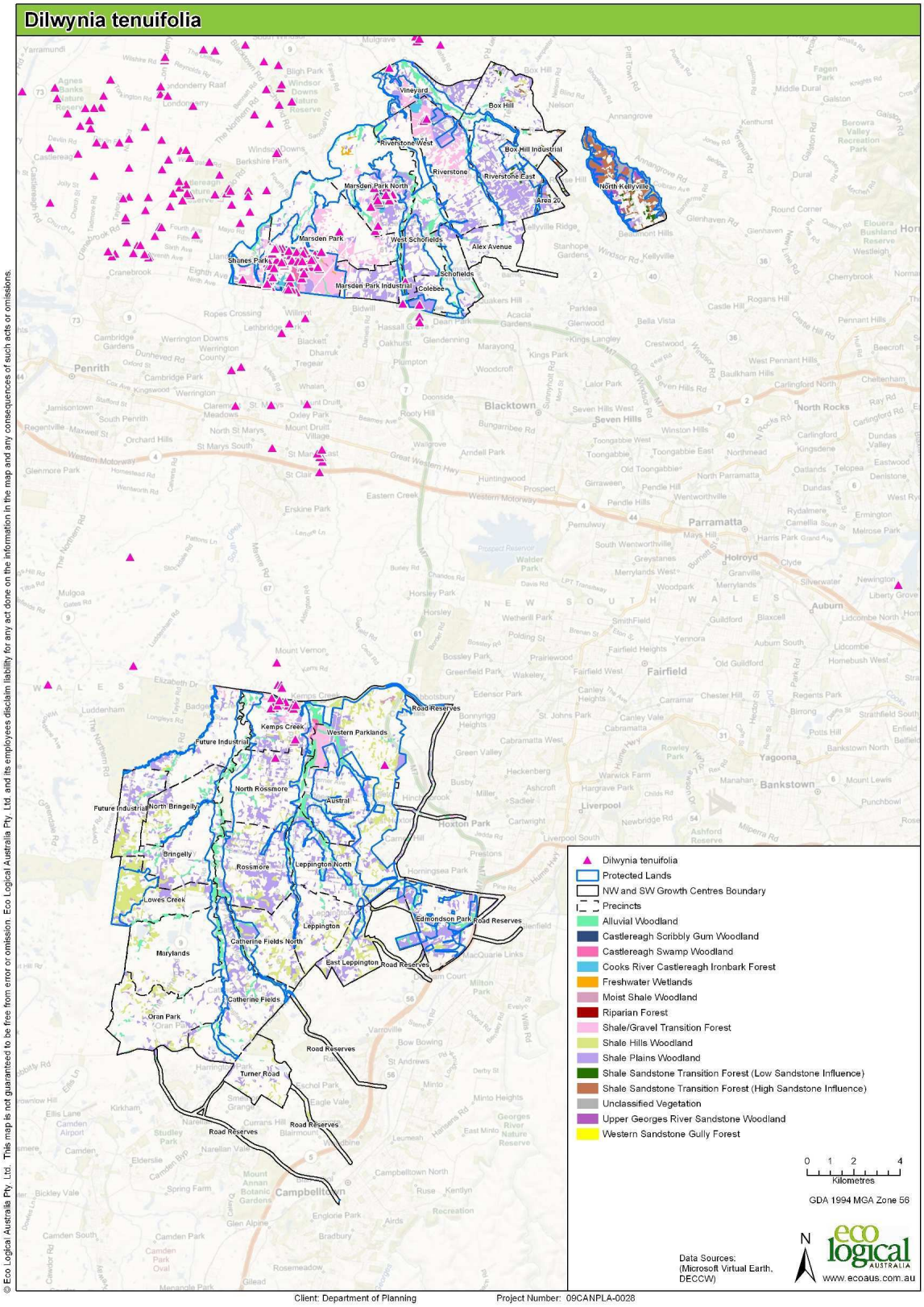

Figure 45: Species distribution and location of NSW Wildlife Atlas records for *Dillwynia tenuifolia* within and immediately surrounding the Growth Centres.

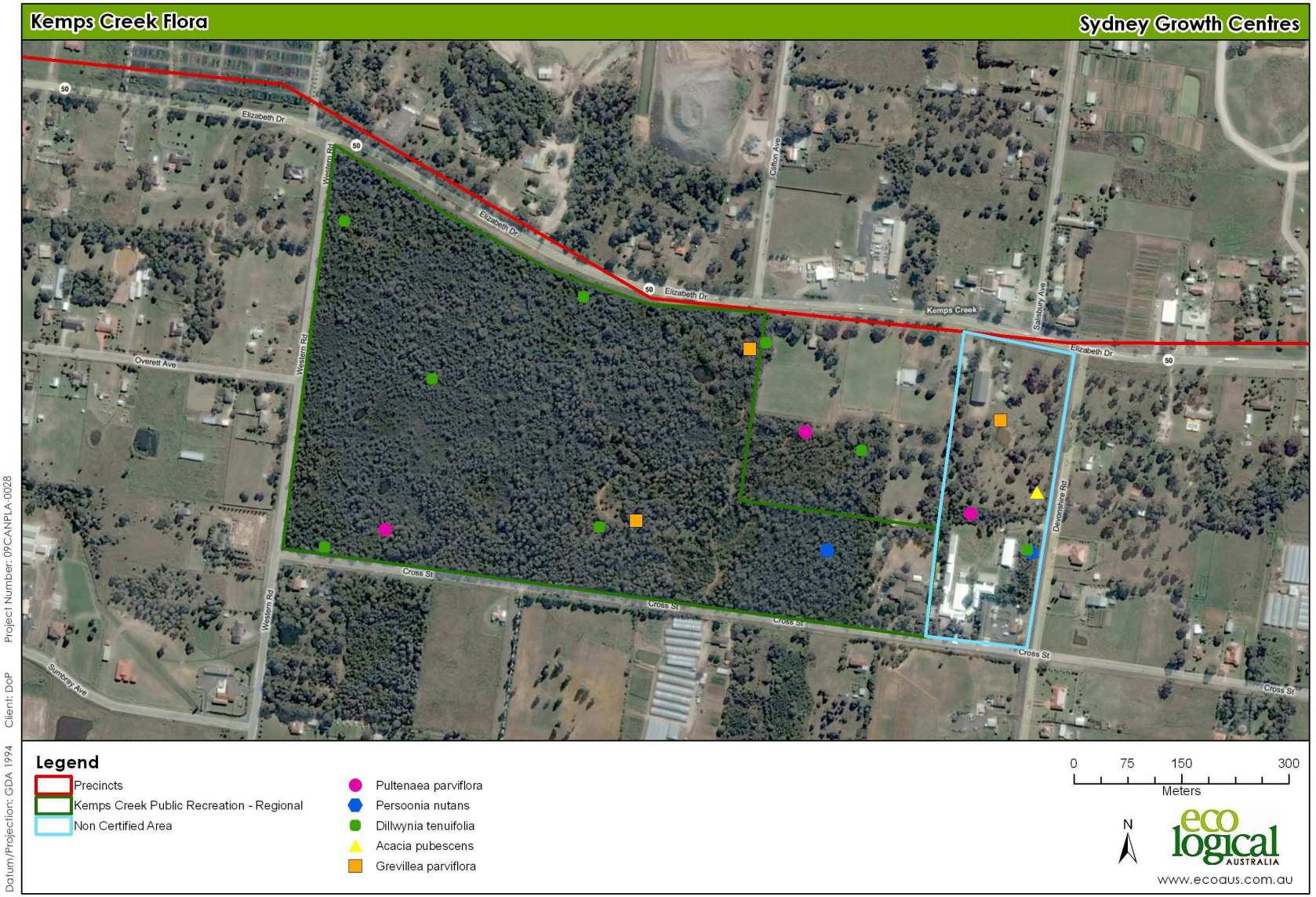

Figure 46: Location of reliable records of EPBC listed threatened flora within and around the 'Public Recreation – Regional' zone of the Kemps Creek Precinct.

5.4.3 POTENTIAL IMPACTS TO *DILLWYNIA TENUIFOLIA* AS A RESULT OF DEVELOPMENT WITHIN THE GROWTH CENTRES

Within the Growth Centres, the following direct impacts to *D. tenuifolia* are expected:

- Loss of the population within the Riverstone Precinct (containing over 300 plants), the population within the North Rossmore Precinct and the smaller population (containing around 100 plants) within the Kemps Creek Precinct.
- Loss of a small component of the population within the Marsden Park North Precinct which occurs within certified lands. However, the majority (over 10,000 plants) of the population within the Marsden Park North Precinct will be retained within the area zoned for Environment Conservation.
- Loss of a small component (around 430 plants) of the large population that occurs towards the north of the Kemps Creek Precinct. Again, the majority (over 5,800 plants) of the population will be retained within the area zoned for Public Recreation – Regional. A further component (over 500 plants) of the population is located within the non-certified area adjacent to the Public Recreation – Regional zone. The Program requires that this area be surveyed to verify the presence of *D. tenuifolia* and if confirmed present, protection of the area of suitable habitat will be provided to the satisfaction of DECCW.

A small component of the population adjacent to the Colebee Precinct is located on land identified as flood prone and major creeks and is therefore afforded some protection from the direct impacts of development. The majority (at least 5,000 plants) of the population is protected within the non-certified area purchased by the RTA for transfer to DECCW as part of the M7 Westlink Motorway offsets.

The remaining known records for *D. tenuifolia* are located within areas zoned to retain and protect their environmental values (that is, areas zoned for Environment Conservation and Public Recreation – Regional). Thus direct impacts to these plants are not expected. However, indirect impacts to these populations from development within the Growth Centres will need to be considered and managed. In general, urban development has the potential to impact adjoining areas of bushland through various edge effects such as:

- the introduction of weeds and exotic species which can outcompete and displace individuals of *D. tenuifolia*;
- the spread of rubbish;
- increased disturbance and trampling from pedestrian access and associated recreational activities;
- runoff from construction containing nutrients, sediments and other pollutants; and
- inappropriate water, sewer and stormwater management leading to erosion.

Due to the presence of potential habitat for *D. tenuifolia* in areas that have not been surveyed within the Growth Centres, additional impacts to the species may occur as a result of development. The extent of these additional impacts is presently unknown. However, as discussed in the previous section it is considered unlikely that additional important areas exist.

5.4.4 PROPOSED MEASURES TO PREVENT, MITIGATE AND MANAGE POTENTIAL IMPACTS TO *DILLWYNIA TENUIFOLIA*

The key measure to prevent, mitigate and manage potential impacts to *D. tenuifolia* is the retention and protection of habitat supporting the four important populations known to occur within the Growth Centres. These include the populations within the Marsden Park North Precinct, the Air Services Australia site at Shanes Park, the area adjacent to the Colebee Precinct and the large population within the Kemps Creek Precinct. It is considered unlikely that additional important areas to those identified through the NSW Wildlife Atlas records exist.

Direct impacts to these important populations have been minimised or avoided. They have each been afforded a level of protection through the Program, ensuring a positive net outcome compared with the status quo.

MARSDEN PARK NORTH PRECINCT

There will be minimal impact to the Marsden Park North population with over 10,000 plants retained, protected and managed in perpetuity. The protection and on-going security for this population is enabled through zoning as Environment Conservation which triggers acquisition by the NSW Government. This land is currently being acquired by the NSW Government from funding separate to the Conservation Fund.

Indirect impacts to this population will be actively managed to minimise and avoid degradation which can result when there are environmentally sensitive lands adjoining urban areas.

AIR SERVICES AUSTRALIA SITE AT SHANES PARK

There will be no direct impacts to the population within the Air Services Australia site at Shanes Park. Similar to the Marsden Park North population, this population will be protected and provided with on-going security through zoning as Environment Conservation.

Indirect impacts to this population will be actively managed to minimise and avoid degradation which can result when there are environmentally sensitive lands adjoining urban areas.

AREA ADJACENT TO THE COLEBEE PRECINCT

The large population that occurs on land adjacent to the Colebee Precinct will be retained in an existing conservation area purchased by the RTA for transfer to DECCW as part of the M7 Westlink Motorway offsets. A small component of this population is also located on land identified as flood prone and major creeks. There are unlikely to be any direct impacts to this component of the population.

KEMPS CREEK PRECINCT

While there will be some loss of plants (around 430 plants) within the certified area of the Kemps Creek Precinct, the majority (at least 5,800 plants) of the large population of *D. tenuifolia* that occurs towards the north of the Kemps Creek Precinct will be retained, protected and managed in perpetuity.

The protection and on-going security for this population is enabled through zoning as Public Recreation – Regional, which triggers acquisition by the NSW Government.

A further component (over 500 plants) of the population is also thought to occur within the non-certified area adjacent to the Public Recreation – Regional zone (see Figure 46). The Program requires that this area be surveyed to verify the presence of *D. tenuifolia* and if confirmed present, protection of the area of suitable habitat will be provided to the satisfaction of DECCW.

Indirect impacts to this population will be actively managed to minimise and avoid degradation which can result when there are environmentally sensitive lands adjoining urban areas.

5.4.5 PROPOSAL TO OFFSET POTENTIAL IMPACTS TO *DILLWYNIA TENUIFOLIA*

There are likely to be some residual impacts to *D. tenuifolia* as a result of development within the Growth Centres. These residual impacts relate to the loss of the known population of 300 plants within the Riverstone Precinct and the loss of areas of potential habitat around the Colebee/Schofields area, the north Riverstone/Vineyard area and the Kemps Creek area.

As mentioned previously, to date, one property, the Cranebrook site, has been purchased with the help of funds from the Growth Centres Offset Program. The site is located southwest of Castlereagh Nature Reserve and supports a very large and significant population of *D. tenuifolia.* At this site, it is estimated that the population consists of 125,000 to 222,000 plants (Jones 2007).

The security of this population in a reserve system is considered to adequately compensate for the known and potential residual impacts of development within the Growth Centres.

5.4.6 CONSERVATION OUTCOME FOR *DILLWYNIA TENUIFOLIA*

The Growth Centres support a number of important known populations of *D. tenuifolia.*

Within the North West Growth Centre, three important populations occur. These include one within the Marsden Park North Precinct, one within the Air Services Australia site at Shanes Park and one within the area adjacent to the Colebee Precinct. These populations have been identified as important for the species preservation due to their significant size and occurrence within intact habitat close to the south-eastern limit of the species distribution.

Within the South West Growth Centre, one important population occurs towards the north of the Kemps Creek Precinct. This population has been listed as an Endangered Population under Section 11 of the NSW TSC Act as the population is disjunct, occurs on unreserved land and is at the spatial limit of the known distribution of the species.

While there are additional areas of suitable habitat within the Growth Centres that have not been surveyed, it is considered unlikely that any additional important populations occur in these areas.

The Program is expected to deliver a positive net outcome for *D. tenuifolia.* Direct impacts to the four known areas supporting important populations are effectively avoided. One of these populations (the population on land adjacent to the Colebee Precinct) is already protected through existing conservation provisions. The remaining three populations are afforded protection and on-going management through zoning and acquisition or transfer of the land to the NSW Government for conservation purposes. In the absence of this protection, each of these populations would be at risk of serious decline and habitat degradation from adjoining urban areas and potential future development.

Despite these measures, there will be some level of impact to *D. tenuifolia* as a result of development within the Growth Centres. This impact includes the loss of a small population of around 300 plants in the Riverstone Precinct and the loss of areas of potential habitat around the Colebee/Schofields area, the north Riverstone/Vineyard area and the Kemps Creek area. It is considered that these known and potential impacts have been more than adequately offset through the purchase of the Cranebrook site, which supports a very large and significant population of *D. tenuifolia.*

CONSISTENCY WITH THE DRAFT CUMBERLAND PLAIN RECOVERY PLAN

There is currently a draft recovery plan for the Cumberland Plain which addresses *D. tenuifolia* (including the NSW listed endangered population within Kemps Creek) as a component of the threatened biodiversity on the Cumberland Plain (DECCW 2009b).

The conservation activities and outcomes for this species that will occur as a consequence of the Program are not inconsistent with this draft recovery plan.

5.5 GREVILLEA PARVIFLORA SUBSP. PARVIFLORA

5.5.1 SPECIES DESCRIPTION

Grevillea parviflora subsp. *parviflora* is a spindly shrub, growing up to 2 metres high with white, spider-like flowers. It is listed as vulnerable under both the Commonwealth EPBC Act and the NSW TSC Act.

Within the Sydney Basin this species is distributed sporadically south west of Sydney with the main extant occurrences centred in the Picton, Appin, Wedderburn and Bargo districts; historically it is known to have occurred as far north as Prospect. Separate and disjunct populations are also known well to the north of Sydney, at Putty, the Wyong - Lake Macquarie area on the Central Coast, and the Cessnock - Kurri Kurri area in the Lower Hunter (DEC 2005q). A population may also occur at Moss Vale in NSW, which would be the southern limit of the species range if confirmed present. There are at least 21 known populations of *G. parviflora* subsp. *parviflora*, however three of these are thought to be extinct and several older records of the plant need to be confirmed (NPWS 2002e).

All populations are thought to be capable of reproducing from rhizomatous suckers, and this is commonly observed, including in areas subject to occasional or moderate disturbance, such as along roadsides. The degree of clonality within populations is unknown, although it is likely that some smaller populations have a high to very high proportion of clonality. The capacity for successful sexual reproduction within and between clones and populations is untested. Most but not necessarily all populations also reproduce from seed. Habit varies from dwarf shrubs to c. 30 centimetres tall (e.g. Kemps Creek) to erect spindly shrubs 2 metres tall (e.g. Wedderburn). Morphological variation overall is however less in the “southern metapopulation” (i.e. SW Sydney Basin) than in the “northern metapopulation” (Central Coast/Hunter) (pers comm. R.O. Makinson, 18 February 2010). The exact number of mature reproducing plants of *G. parviflora* subsp. *parviflora* is uncertain. Sucker stems (rhizomatous ramets) often occur in patches close to the parent plant and population estimates can be a reflection of the number of suckers (ramets) rather than individual plants (NPWS 2002e).

Population size varies but are mostly small (less than 20 plants) to medium size (50–100 plants) with few large populations (greater than 200 plants). The largest known population occurs north of Bargo with an estimated 2,000 or more plants (NPWS 2002e). Within the NSW NPWS Environmental Impact Assessment Guidelines for the species (NPWS 2002f), sites of particular importance for the species are defined as containing populations of greater than 50 individuals, with a varied age structure and evidence of active recruitment.

Habitat for *G. parviflora* subsp. *parviflora* includes sandy or light clay soils usually over thin shales, with individuals growing in a range of vegetation types from heath and shrubby woodland to open forest. It is found over a range of altitudes from flat, low-lying areas to upper slopes and ridge crests and often occurs in open, slightly disturbed sites such as along tracks (DEC 2005q). Amongst others, *G. parviflora* subsp. *parviflora* is associated with the Shale/Sandstone Transition Forest and Turpentine-Ironbark Forest in the Sydney Basin Bioregion. All of these communities are found within the Growth Centres.

As with other plant species occurring within the Cumberland Plain, key threats to the distribution and abundance of *G. parviflora* subsp. *parviflora* include the clearance and fragmentation of habitat, inappropriate fire regimes, uncontrolled vehicular access (including during maintenance of roads and transmission lines), and weed invasion (DEWHA 2009s).

Few of the known populations of *G. parviflora* subsp. *parviflora* are currently in reserves. There are records of the species in Werakata National Park; one population of at least 50 plants within Wirrimbirra

Sanctuary at Bargo (although the conservation status of this area is uncertain); two populations (including one with only one plant) that occur on Sydney Water land within a Schedule 1 Special Area; and a small population is located within a Wildlife Refuge near Maldon (although this area may not provide permanent reservation) (DEWHA 2009s).

5.5.2 *GREVILLEA PARVIFLORA* SUBSP. *PARVIFLORA* WITHIN THE GROWTH CENTRES

There are three reliable records in the NSW Wildlife Atlas for *G. parviflora* subsp. *parviflora* within the South West Growth Centre (NSW Wildlife Atlas 2009). All of these records (shown in Figure 46 and Figure 47) are located in the Kemps Creek Precinct and include:

- two sites where over 110 plants have been recorded within the area that has been zoned for Public Recreation – Regional; and
- a third site where 40 plants have been recorded within the non-certified area (subject to further investigation for *Acacia pubescens* in accordance with Relevant Biodiversity Measure 17).

These sites are all within 500 metres of each other and are therefore considered to be part of the same functional population. This population is seen to be important for the conservation of the species as it is reasonably large, located at the northern edge of the species' distribution (one of only two recorded sites to the north of Wedderburn) and is separated from the nearest population at Voyager Point by over 15 km.

Throughout the Growth Centres, there is limited potential for the species to occur in areas outside of these known records. The core distribution of *G. parviflora* subsp. *parviflora* occurs to the south of the Growth Centres where the species is most commonly associated with Shale Sandstone Transition Forest. However, key habitat for the species within the Growth Centres appears to be different and includes Castlereagh Scribbly Gum Woodland as primary habitat, with other Castlereagh communities providing marginal habitat (pers comm. Teresa James, 19 March 2010).

Within the South West Growth Centre, these vegetation communities are only found as a localised occurrence within the Kemps Creek Precinct where the species has been recorded. As such, while targeted surveys have not been undertaken throughout the Growth Centres, the NSW Wildlife Atlas records for the species appear to adequately identify important areas of habitat. Areas containing potentially suitable vegetation within the North West Growth Centre are unlikely to support *G. parviflora* subsp. *parviflora* as they are outside of the species distribution.

5.5.3 POTENTIAL IMPACTS TO G*REVILLEA PARVIFLORA SUBSP. PARVIFLORA* AS A RESULT OF DEVELOPMENT WITHIN THE GROWTH CENTRES

The majority (over 110 plants) of the population within the Kemps Creek Precinct will be retained through its zoning as Public Recreation – Regional and purchase using the Conservation Fund. However, a component (around 40 plants) of the population is located within the non-certified area subject to further investigation for *Acacia pubescens* (under RBM 17). The Program requires that this area be surveyed to verify the presence of *G. parviflora* subsp. *parviflora* and if confirmed present, protection of the area of suitable habitat will be provided to the satisfaction of DECCW. Thus direct impacts to these plants are not expected.

Where occurrences of *G. parviflora* subsp. *parviflora* will be retained within areas zoned for Public Recreation – Regional (and potentially in the non-certified area), indirect impacts from development

within the Growth Centres will need to be considered and managed. In general, urban development has the potential to impact adjoining areas of bushland through various edge effects such as:

- the introduction of weeds and exotic species which can outcompete and displace individuals of *G. parviflora* subsp. *parviflora*;
- the spread of rubbish;
- increased disturbance and trampling from pedestrian access and associated recreational activities;
- runoff from construction containing nutrients, sediments and other pollutants; and
- inappropriate water, sewer and stormwater management leading to erosion.

As it is unlikely that important populations of the species occur in areas that have not been surveyed within the Growth Centres, additional impacts to the species as a result of development are considered unlikely.

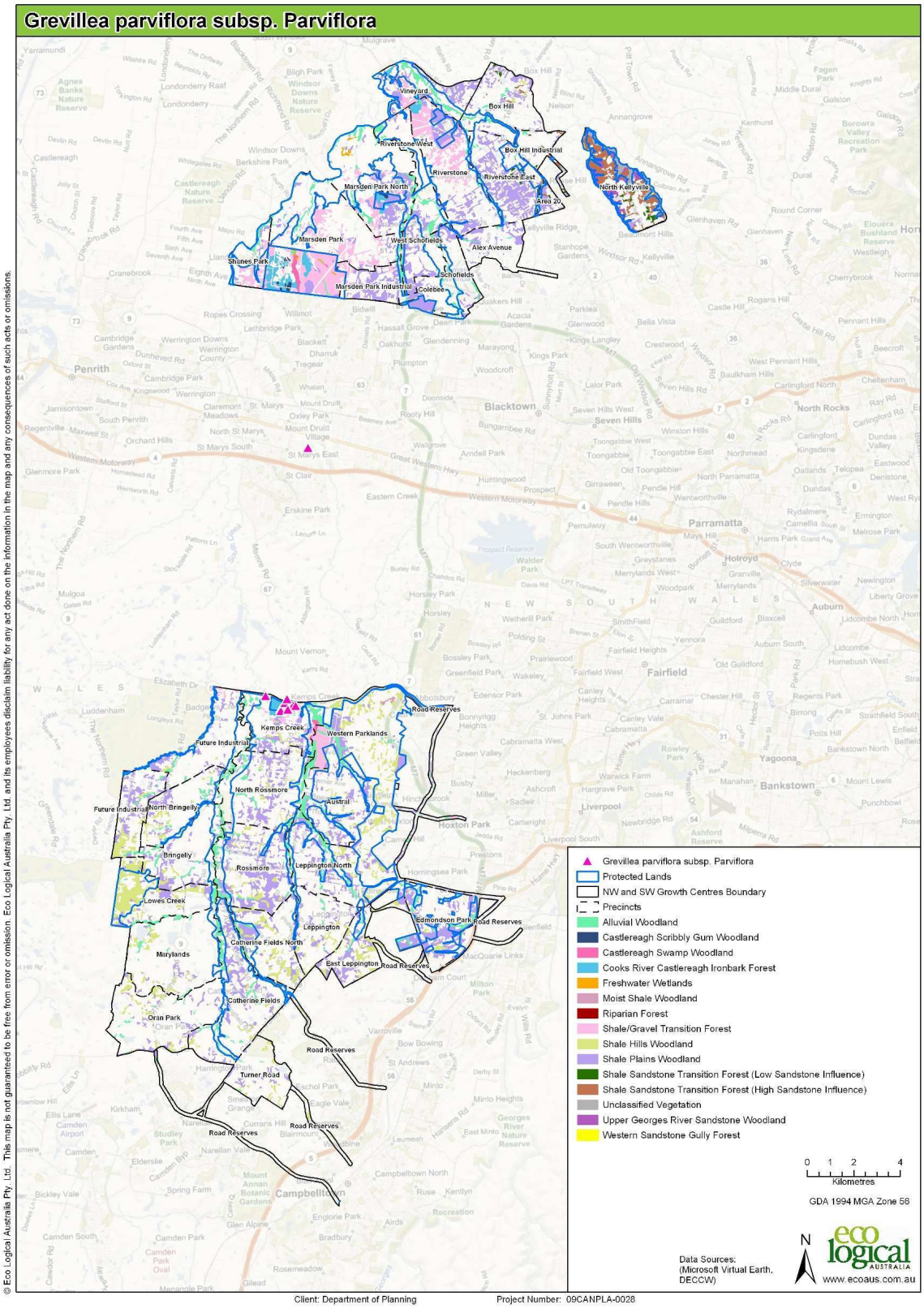

Figure 47: Species distribution and location of NSW Wildlife Atlas records for *G. parviflora* subsp. *parviflora* within and immediately surrounding the Growth Centres.

5.5.4 PROPOSED MEASURES TO PREVENT, MITIGATE AND MANAGE POTENTIAL IMPACTS TO *GREVILLEA PARVIFLORA* SUBSP. *PARVIFLORA*

The key measures to prevent, mitigate and manage potential impacts to the species are the retention and protection of habitat supporting the known population at Kemps Creek. Direct impacts to this population will be avoided. Two sites containing the majority of the known population will be protected and provided with ongoing security through zoning as Public Recreation – Regional which triggers acquisition by the NSW Government.

As shown in Figure 46, a further component (40 plants) of the population is thought to occur within the non-certified area at Kemps Creek. If the presence of the species is confirmed in the non-certified area during precinct planning, protection of the area of suitable habitat will be provided to the satisfaction of DECCW.

It is considered unlikely that important populations of this species are present in unsurveyed areas outside of this known Kemps Creek population. Therefore, the retention and management of this important population will ensure a positive net outcome compared with the status quo.

5.5.5 PROPOSAL TO OFFSET POTENTIAL IMPACTS TO *GREVILLEA PARVIFLORA* SUBSP. *PARVIFLORA*

As all individuals within the Kemps Creek important population will be retained and managed, and it is considered unlikely that there will be residual impacts to *G. parviflora* subsp. *parviflora* as a result of development within the Growth Centres. Offsets are therefore not considered necessary for this species.

5.5.6 CONSERVATION OUTCOME FOR *GREVILLEA PARVIFLORA* SUBSP. *PARVIFLORA*

The South West Growth Centre supports one known population of *G. parviflora* subsp. p*arviflora.* This population occurs at Kemps Creek, and is considered important due to its occurrence in the northern limit of the species distribution and its reasonably large size.

While targeted surveys have not been undertaken throughout the Growth Centres, it is considered unlikely that any additional important populations occur in within these areas.

Direct impacts to the known population will be avoided through the designation of the Public Recreation – Regional zone at Kemps Creek which contains the majority of this population (110 plants). This area will be acquired and then retained, protected and managed in perpetuity.

A further component (40 plants) of the population is also thought to occur within the non-certified area at Kemps Creek. If the presence of the species is confirmed in the non-certified area, protection of the area of suitable habitat will be provided to the satisfaction of DECCW.

Indirect impacts to this population will be actively managed to minimise and avoid degradation which can result when there are environmentally sensitive lands adjoining urban areas.

As this important population will be retained and managed in its entirety, the Program is expected to deliver a net positive outcome for *G. parviflora* subsp. *parviflora.*

Note that there is currently no recovery plan for this species.

5.6 MICROMYRTUS MINUTIFLORA

5.6.1 SPECIES DESCRIPTION

Micromyrtus minutiflora is a slender spreading shrub, growing up to 2 m high, with small white flowers. It is listed as vulnerable under the Commonwealth EPBC Act and endangered under the NSW TSC Act.

M. minutiflora is endemic to the western parts of the Cumberland Plain. The species' distribution is restricted to areas between Richmond and Penrith across the Blacktown, Hawkesbury and Penrith local government areas (TSSC 2008a). An analysis of all records for this species was undertaken as part of the preparation of the Draft Cumberland Plain Recovery Plan. For the purposes of the analysis, populations were delineated by geographic discontinuities of over 1 kilometre between reliable records and sites were delineated by geographic discontinuities of over 200 metres between reliable records. The analysis identified 35 sites comprising 11 populations of *M. minutiflora*.

The species habitat occurs on sandy clay or gravelly soils of tertiary alluvium. Associated vegetation communities in which the species occurs includes Castlereagh Scribbly Gum Woodland, Ironbark Forest (including Cooks River Castlereagh Ironbark Forest) and Shale Gravel Transition Forest (TSSC 2008a; DECC 2005b).

Given the limited distribution of the species, *M. minutiflora* is particularly susceptible to the threat of local population extinction. Such impacts have the potential to occur as a result of habitat loss through vegetation clearing for urban development, frequent fire, and habitat degradation through weed invasion, arson, grazing, trail bike riding and rubbish dumping (TSSC 2008a).

Two existing reserves and one soon to be gazetted reserve contain occurrences of the species. One population of fewer than 50 plants is conserved within the Castlereagh Nature Reserve (DECC 2002) and the species is also present in the gazetted section of Wianamatta Regional Park. An estimated 366,000 to 522,000 plants occur on the Cranebrook site that has been purchased for the purpose of reservation by the NSW Government (Eco Logical Australia 2007).

5.6.2 *MICROMYRTUS MINUTIFLORA* WITHIN THE GROWTH CENTRES

NSW Wildlife Atlas records for *M. minutiflora* within and around the North West Growth Centre are shown in Figure 48. No records exist within or surrounding the South West Growth Centre.

There is one population (comprising three records) reliably recorded from the Growth Centres in the NSW Wildlife Atlas. This population occurs in the Marsden Park North Precinct within the North West Growth Centre. This population is considered to be important as it is a significantly large and healthy population around the eastern limit of the species distribution (NPWS 1997).

Although no NSW Wildlife Atlas records exist for the Air Services Australia site at Shanes Park, this site is reported to support a significant population of *M. minutiflora* in the Urban Bushland Biodiversity Survey report (NPWS 1997).

Within the Growth Centres, key habitat areas for *M. minutiflora* are associated with Castlereagh vegetation communities, and there is potential for the species to occur in Shale Gravel Transition Forest (pers comm. Teresa James, 19 March 2010) While these communities are present in both Growth Centres, the South West Growth Centre is located outside of the known distribution of the species.

The North West Growth Centre is within the species' known range. There is suitable habitat for *M. minutiflora* within this area, and potential for the species to occur in unsurveyed areas. These areas

may include the remnants of Shale Gravel Transition Forest around Marsden Park and further north around the Riverstone/Vineyard area; although this community is considered to provide only marginal habitat for the species.

It is considered unlikely that the North West Growth Centre supports additional important populations of *M. minutiflora*. As the NSW Wildlife Atlas records confirm, the species is most strongly associated with the Castlereagh vegetation communities. The Castlereagh communities that occur within the North West Growth Centre include the remnants of Castlereagh Scribbly Gum Woodland and Cooks River Castlereagh Ironbark Forest within the Air Services Australia land at Shanes Park, the area zoned for Public Recreation – Regional within Marsden Park North and a small, fairly isolated remnant in the Vineyard Precinct. As both the Shanes Park site and the Marsden Park North site are known to support important populations of *M. minutiflora*, areas of additional key habitat is limited, which restricts the potential for further important populations to exist. The NSW Wildlife Atlas records for the species are therefore considered to adequately identify the key or important habitat areas within the Growth Centres.

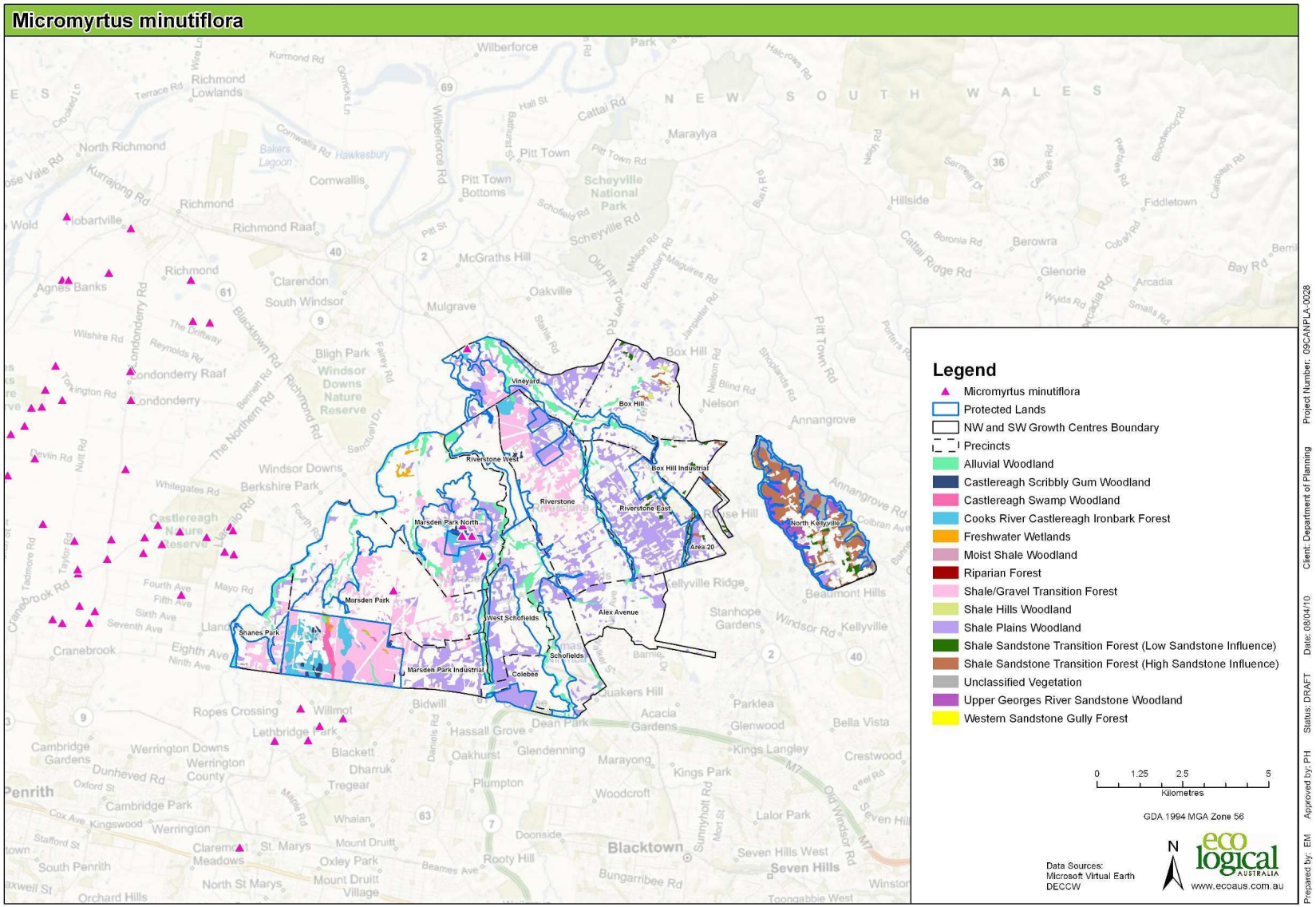

Figure 48: NSW Wildlife Atlas records for *M. minutiflora* within and around the North West Growth Centre.

5.6.3 POTENTIAL IMPACTS TO *MICROMYRTUS MINUTIFLORA* AS A RESULT OF DEVELOPMENT WITHIN THE GROWTH CENTRES

Direct impacts to known populations of *M. minutiflora* within the Growth Centres have been minimised.

There will be some direct loss of a component of the population within the Marsden Park North Precinct. In the absence of an estimate in population size, the NSW Wildlife Atlas records provide the only method of quantifying the level of impact. This population is represented by three records. Two of these records will be retained as they occur within a non-certified area that is zoned for Environment Conservation, while the third is in the certified area and is therefore expected to be lost.

Indirect impacts will also need to be considered and managed for the two areas supporting known populations of *M. minutiflora* that will be retained within areas zoned for Environment Conservation, including the population within the Air Service Australia site at Shanes Park and the retained plants within the Marsden Park North Precinct. In general, urban development has the potential to impact adjoining areas of bushland through various edge effects such as:

- the introduction of weeds and exotic species which can outcompete and displace individuals of *M. minutiflora*;
- the spread of rubbish;
- increased disturbance and trampling from pedestrian access and associated recreational activities;
- runoff from construction containing nutrients, sediments and other pollutants; and
- inappropriate water, sewer and stormwater management leading to erosion.

Due to the presence of potential habitat for *M. minutiflora* within the North West Growth Centre in areas that have not been surveyed, additional impacts to the species may occur as a result of development. The extent of these additional impacts is unknown. However, as discussed in the previous section it is considered unlikely that there will be additional impacts to any areas of importance to the species.

5.6.4 PROPOSED MEASURES TO PREVENT, MITIGATE AND MANAGE POTENTIAL IMPACTS TO *MICROMYRTUS MINUTIFLORA*

The key measure to prevent, mitigate and manage potential impacts to *M. minutiflora* is the retention and protection of habitat supporting the two important populations known to occur within the Growth Centres. These include the populations within the Marsden Park North Precinct and the Air Services Australia site at Shanes Park. It is considered unlikely that additional important areas, other than those identified through the NSW Wildlife Atlas records exist.

Direct impacts to these important populations have been minimised or avoided. They have each been afforded a level of protection through the Program, ensuring a positive net outcome compared with the status quo.

MARSDEN PARK NORTH PRECINCT

While there will be some impact to the Marsden Park North population, these impacts have been minimised with the majority (quantified in number of records in the absence of plant numbers) to be protected and managed in perpetuity.

The protection and on-going security for this population is enabled through zoning as Environment Conservation which triggers acquisition by the NSW Government. This land is currently being acquired by the NSW Government using funding separate to the Conservation Fund.

Indirect impacts to this population will be actively managed to minimise and avoid degradation which can occur when there are environmentally sensitive lands adjoining urban areas.

AIR SERVICES AUSTRALIA SITE AT SHANES PARK

There will be no direct impact to the population within the Air Services Australia site at Shanes Park. This population will be protected and provided with on-going security through zoning as Environment Conservation.

Indirect impacts to this population will also be actively managed to minimise and avoid degradation which can result when there are environmentally sensitive lands adjoining urban areas.

5.6.5 PROPOSAL TO OFFSET POTENTIAL IMPACTS TO *MICROMYRTUS MINUTIFLORA*

There are likely to be some residual impacts to *M. minutiflora* as a result of development within the Growth Centres. These residual impacts relate to the loss of a component of the known population within the Marsden Park North Precinct and the loss of areas of potential habitat around the Marsden Park area and further north in the Riverstone/Vineyard area.

To date, one property has been purchased through the Growth Centres Offset Program which supports a very large and significant population of *M. minutiflora.* As mentioned previously, this population occurs on the Cranebrook site, located southwest of Castlereagh Nature Reserve. At this site, it is estimated that the population consists of around 366,000 to 522,000 plants (Eco Logical Australia 2007).

The security of this population in a reserve system is considered to adequately compensate for the known and potential residual impacts of development within the Growth Centres.

5.6.6 CONSERVATION OUTCOME FOR *MICROMYRTUS MINUTIFLORA*

The Growth Centres support two important populations of *M. minutiflora,* both of which occur within the North West Growth Centre. These include a population within the Marsden Park North Precinct and one within the Air Services Australia site at Shanes Park.

There are some additional areas of potential habitat within the North West Growth Centre that have not been surveyed. However, it is considered unlikely that any additional important populations occur in these areas.

The Program is expected to deliver a positive net outcome for *M. minutiflora.* Both populations, considered to be important to the preservation of the species as they are of a significantly large and healthy size and occur around the eastern limit of the species distribution, are afforded protection and on-going management. In the absence of this protection, each of these populations would be at risk of serious decline and habitat degradation from adjoining urban areas and potential future development.

Despite these measures, there will be some level of impact to *M. minutiflora* as a result of development within the Growth Centres. This impact includes the loss of a component of the known population within the Marsden Park North Precinct and the loss of areas of potential habitat around the Marsden Park area and further north in the Riverstone/Vineyard area. It is considered that these known and potential

impacts have been more than adequately offset through the purchase of the Cranebrook site, which supports a very large and significant population of *M. minutiflora.*

CONSISTENCY WITH THE DRAFT CUMBERLAND PLAIN RECOVERY PLAN

There is currently a draft recovery plan for the Cumberland Plain which addresses *M. minutiflora* as a component of the threatened biodiversity on the Cumberland Plain (DECCW 2009b).

The conservation activities and outcomes for this species that will occur as a consequence of the Program are not inconsistent with this draft recovery plan.

5.7 PERSOONIA HIRSUTA

5.7.1 SPECIES DESCRIPTION

Persoonia hirsuta is a spreading shrub that grows up to 1.5 metre tall with yellow flowers. It is listed as endangered under both the Commonwealth EPBC Act and the NSW TSC Act.

The current distribution of *P. hirsuta* occurs across a patchy range of locations including the Sydney Coastal area (subsp. *hirsuta*), and the Blue Mountains, Southern Highlands, Yanderra and Hill Top (subsp. *evoluta*) (Weston and Johnson 1991, DECC 2005r). Intergrades between subsp. *hirsuta* and subsp. *evoluta* extend from Macquarie Fields to Maroota, 15-65 kilometres from the coast below 300 metres (Weston and Johnson 1991). Throughout these areas, the species occurs as individuals or in small groups of less than 10 individual plants. The species is considered to be generally rare throughout the Sydney Region (DEWHA 2009t). Most known locations consist of one to three plants, with the exception of two currently known locations with between 10 and 20 plants (NSW Scientific Committee 1998a). The populations within the Hills Shire are considered particularly important for the conservation of this species as these populations have a high local density of plants (NSW Scientific Committee 1998a).

Habitat for the species consists of dry sclerophyll eucalypt woodland or forest and shrub-woodland, which grow in sandy to stony soils derived from sandstone. The species is rarely found in areas of shale (DEWHA 2009t).

Though little is known of the ecology of the species, it is thought that fire can kill adult plants. However, these plants are likely to be able to regenerate from soil-stored seed (DECC 2005r) although germination triggers are unknown (Weston, cited in Benson & McDougall (2000)). Changes to natural fire regimes for the purposes of hazard reduction may therefore threaten the survival of the species. Other threats to the *P. hirsuta* include clearance of habitat and potential impacts to reproduction of the species as a result of the ineffective pollination techniques of the introduced European Honey bee (*Apis mellifera)* (DECC 2005r).

The species has been recorded from a number of National Parks, including the Blue Mountains, Wollemi, Dharug, Kuring-gai Chase, Marramarra, the Royal and Sydney Harbour National Parks.

5.7.2 *PERSOONIA HIRSUTA* WITHIN THE GROWTH CENTRES

NSW Wildlife Atlas records for *P. hirsuta* within and around the North West Growth Centre are shown in Figure 49. No records exist within the South West Growth Centre.

There is one reliable Atlas record of *P. hirsuta* within the North West Growth Centre, in the North Kellyville Precinct. This record is for one plant, and is located within a non-certified area that was subject to further investigation under the Relevant Biodiversity Measures. Further investigation into the presence of this population was undertaken in August 2007 as part of the more detailed planning for the precinct. However, records of the species within North Kellyville are thought to have been lost to fire. The survey failed to find any presence of the species, supporting the conclusion that this population was killed by fire (Cumberland Ecology 2007) and repeated visits years following the fire suggests that the species is unlikely to regenerate from the soil seedbank.

While targeted surveys have not been undertaken throughout the Growth Centres, the NSW Wildlife Atlas records for the species appear to adequately identify the key or important areas of habitat in the North West Growth Centre. Throughout the Growth Centres, there is limited potential for the species to

occur in areas outside of the known records. Within the Growth Centres, key habitat areas for *P. hirsuta* are associated with Shale Sandstone Transition Forest (high sandstone) and Sydney Sandstone Ridge-top Woodland (pers comm. Teresa James, 19 March 2010) Shale Sandstone Transition Forest is present in the North West Growth Centre, particularly in North Kellyville, and a small area of Sydney Sandstone Ridge-top Woodland occurs in the North Kellyville Precinct. As stated above, targeted surveys for the species within the North Kellyville Precinct did not record any individuals.

The species is considered unlikely to occur in other parts of the Growth Centres as these areas are outside of the recorded distribution of the species and there is little potential habitat.

5.7.3 POTENTIAL IMPACTS TO *PERSOONIA HIRSUTA* AS A RESULT OF DEVELOPMENT WITHIN THE GROWTH CENTRES

The one reliable record for *P. hirsuta* within the Growth Centres is believed to have been lost to fire. There will therefore be no direct impact to known areas supporting the species as a result of development within the Growth Centre.

Although no individuals have been reliably recorded within North Kellyville, potentially suitable habitat for the species occurs within areas zoned as “Environmental Management” through the detailed precinct planning. This zoning affords potential habitat for the species some protection, in accordance with one of its objectives to “*protect, manage and restore areas with special ecological, scientific, cultural or aesthetic values*”.

As it is unlikely that important populations of the species occur in areas that have not been surveyed within the Growth Centres, additional impacts to the species as a result of development are considered unlikely.

5.7.4 PROPOSED MEASURES TO PREVENT, MITIGATE AND MANAGE POTENTIAL IMPACTS TO *PERSOONIA HIRSUTA*

As the one reliable record for *P. hirsuta* within the Growth Centres is believed to have been lost to fire, there will be no direct impact to the species through development associated with the Growth Centres.

While no populations are known to occur within North Kellyville, potential habitat will be retained through the zoning of Environmental Management areas.

5.7.5 PROPOSAL TO OFFSET POTENTIAL IMPACTS TO *PERSOONIA HIRSUTA*

Offsets are not considered necessary for this species given the limited potential for impacts.

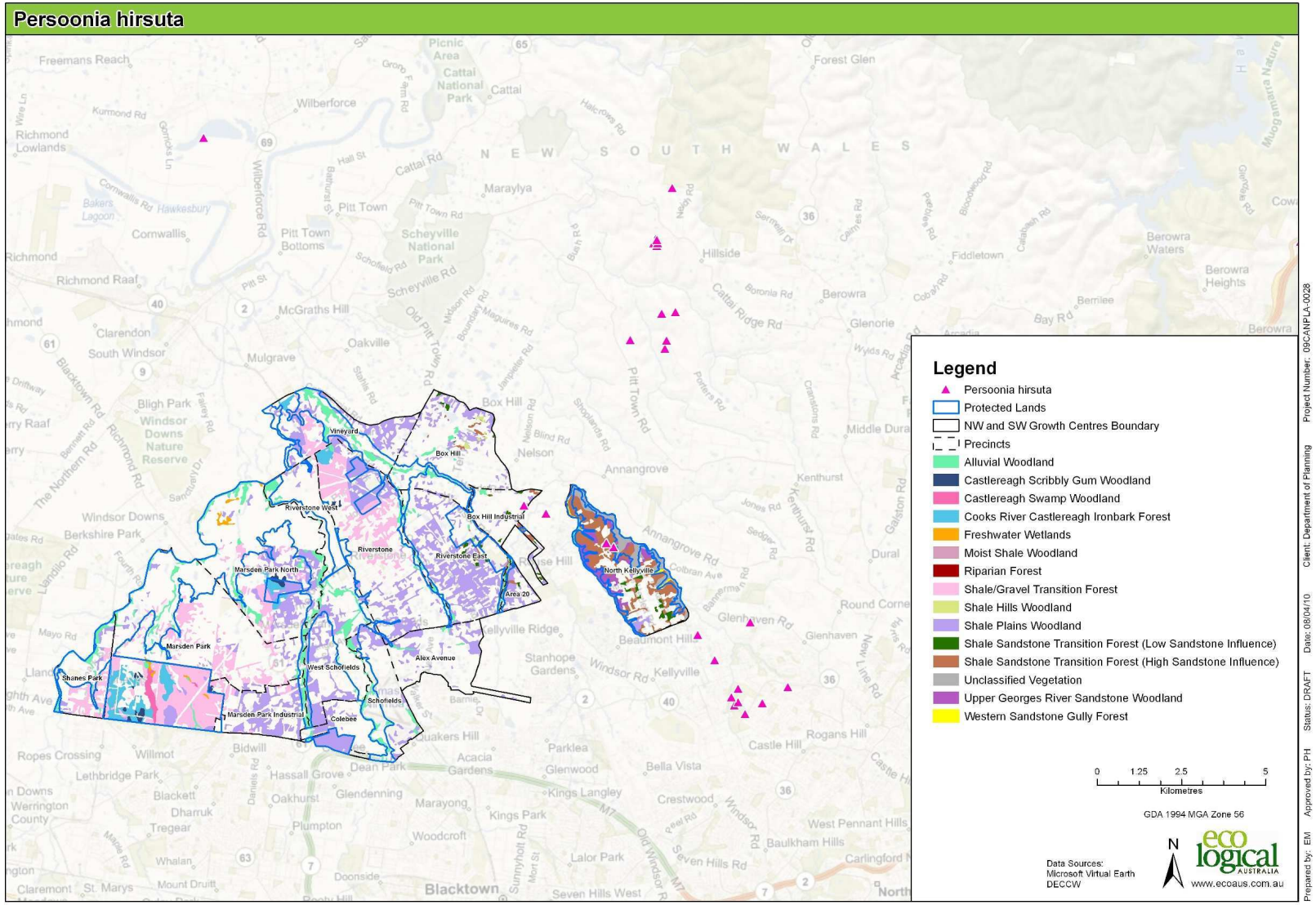

Figure 49: Species distribution and location of NSW Wildlife Atlas records for *Persoonia hirsuta* within and surrounding the North West Growth Centre

5.7.6 CONSERVATION OUTCOME FOR *PERSOONIA HIRSUTA*

There is one reliable NSW Wildlife Atlas record of *P. hirsuta* within the North West Growth Centre, in the North Kellyville Precinct. This record is for one plant, and is located within an area that has been affected by fire. Targeted surveys (Cumberland Ecology 2007) failed to find any presence of the species, supporting the conclusion that this population was killed by fire. There are no records of *P. hirsuta* from the South West Growth Centre.

While targeted surveys have not been undertaken throughout the Growth Centres, it is considered unlikely that any additional important populations occur given the general lack of suitable habitat.

As there are no current records of the species within the Growth Centres, impacts from the Program are not expected.

While no populations are known to occur within North Kellyville, potential habitat will be retained within the precinct through the zoning of areas as E3 Environmental Management. Development controls for this zone prohibit the clearing of native vegetation.

Note that there is currently no recovery plan for this species.

5.8 PERSOONIA NUTANS

5.8.1 SPECIES DESCRIPTION

Persoonia nutans is an erect to spreading shrub 0.5-1.5 metre high with pendant shaped yellow flowers. It is listed as endangered under both the Commonwealth EPBC Act and the NSW TSC Act.

P. nutans is restricted to the Cumberland Plain in Western Sydney. It occurs between Richmond in the north and Macquarie Fields in the south. The species distribution is disjunct, with 99% of individuals occurring in the north of the species range in the Agnes Banks, Londonderry, Castlereagh, Berkshire Park and Windsor Downs areas (DEC 2005s). Specific localities at which this species has been recorded include: Londonderry; Kemps Creek; Georges River opposite East Hills; Macquarie Fields and near the Richmond and Nepean Rivers (DEWHA 2009u).

Current known estimates of population size were obtained largely from survey work undertaken in 1996 (DEC 2006a). *P. nutans* is a fire sensitive obligate seeder, and as such, the species exhibits considerable fluctuations in the number of mature individuals over time, depending upon time since fire. Available information suggests that the total number of mature *P. nutans* individuals across all 25 known populations is greater than 5,500, with the majority of populations having fewer than 10 individuals (DEC 2006a). The southern part of the species range supports approximately 1% of individuals (DEC 2006a).

The ecology of *P. nutans* is not well understood, however it is considered to be a relatively short-lived species similar to other obligate seed regenerating species which reach maturity in about 10 years. The species is known to be associated with dry woodland, including Castlereagh Scribbly Gum Woodland, Cooks River Castlereagh Ironbark Forest, Agnes Banks Woodland and Shale Gravel Transition Forest. *P. nutans* is confined to aeolian and alluvial sediments. This accounts for its disjunct distribution, as these deposits are extensive in the north, whereas in the south these deposits are limited and the species is considerably less abundant.

Immediate threats to the survival of populations of *P. nutans* include inappropriate fire regimes and habitat loss through clearing and degradation (DECC 2006a).

The majority (70%) of known individuals of *P. nutans* occur within conservation reserves within the north of the species range and include Agnes Banks Nature Reserve, Windsor Downs Nature Reserve, Castlereagh Nature Reserve and the proposed Wianamatta Regional Park (former ADI site). However, as noted in the recovery plan for the species, there are likely to be numerous additional sites supporting *P. nutans* that have not yet been recorded (DEC 2005s).

5.8.2 *PERSOONIA NUTANS* WITHIN THE GROWTH CENTRES

There are two reliable NSW Wildlife Atlas records for *P. nutans* within the Growth Centres (NSW Wildlife Atlas 2009). These records all occur within the Kemps Creek Precinct in the South West Growth Centre as shown in Figure 50.

These records comprise the two populations identified in the Recovery Plan for the species (DEC 2006a) and shown in Figure 46, including:

- one population at the Christadelphian Heritage School, corner of Cross St and Devonshire Road, Kemps Creek where 11-50 individuals were recorded in 1997; and

- one population on the land to the west of Kemps Creek Primary School, where less than 10 individuals were.

These two populations are considered to be important for the species as they represent southern outlier populations associated with localised occurrence of tertiary alluvium.

Within the Growth Centres, key habitat areas for *P. nutans* are associated with Castlereagh vegetation communities, with marginal habitat occurring in Shale Gravel Transition Forest (pers comm. Teresa James, 19 March 2010).

Within the South West Growth Centre, there is some suitable habitat for *P. nutans* outside of areas containing known records, which means there is some potential for the species to occur in areas which have not been surveyed. Potential areas are considered to be limited and include the small remnants of Shale Gravel Transition Forest within the Kemps Creek Precinct, particularly where these remnants grade into the Castlereagh communities. However, it should be noted that the key or most substantial area of suitable habitat for *P. nutans* within the Kemps Creek area is already known to support the species. It is considered unlikely that the additional areas of potential habitat within the area will support important populations of the species.

P. nutans has not been recorded within the North West Growth Centre. However, the species occupies similar habitat to a number of other threatened flora which have been recorded within the North West Growth Centre including *Pultenaea parviflora, Grevillea juniperina, Micromyrtus minutiflora*; all of which have been recorded within the North West Growth Centre. Therefore, it is considered likely that potential habitat for *P. nutans* exists within this region.

The National Recovery Plan for *P. nutans* maps potential habitat areas based on suitable soil type and vegetation (DEC 2006a). Within the Growth Centres, the Plan identifies the Air Services Australia site at Shanes Park as a key area of potential habitat for the species. The species may also occur in other areas within the North West Growth Centre where both *P. parviflora* and *M. minutiflora* are associated with remnants of Castlereagh Scribbly Gum Woodland and Cooks River Castlereagh Ironbark Forest. This includes the area within and around the land zoned for Environment Conservation within the Marsden Park North Precinct and further north around the Riverstone/Vineyard area.

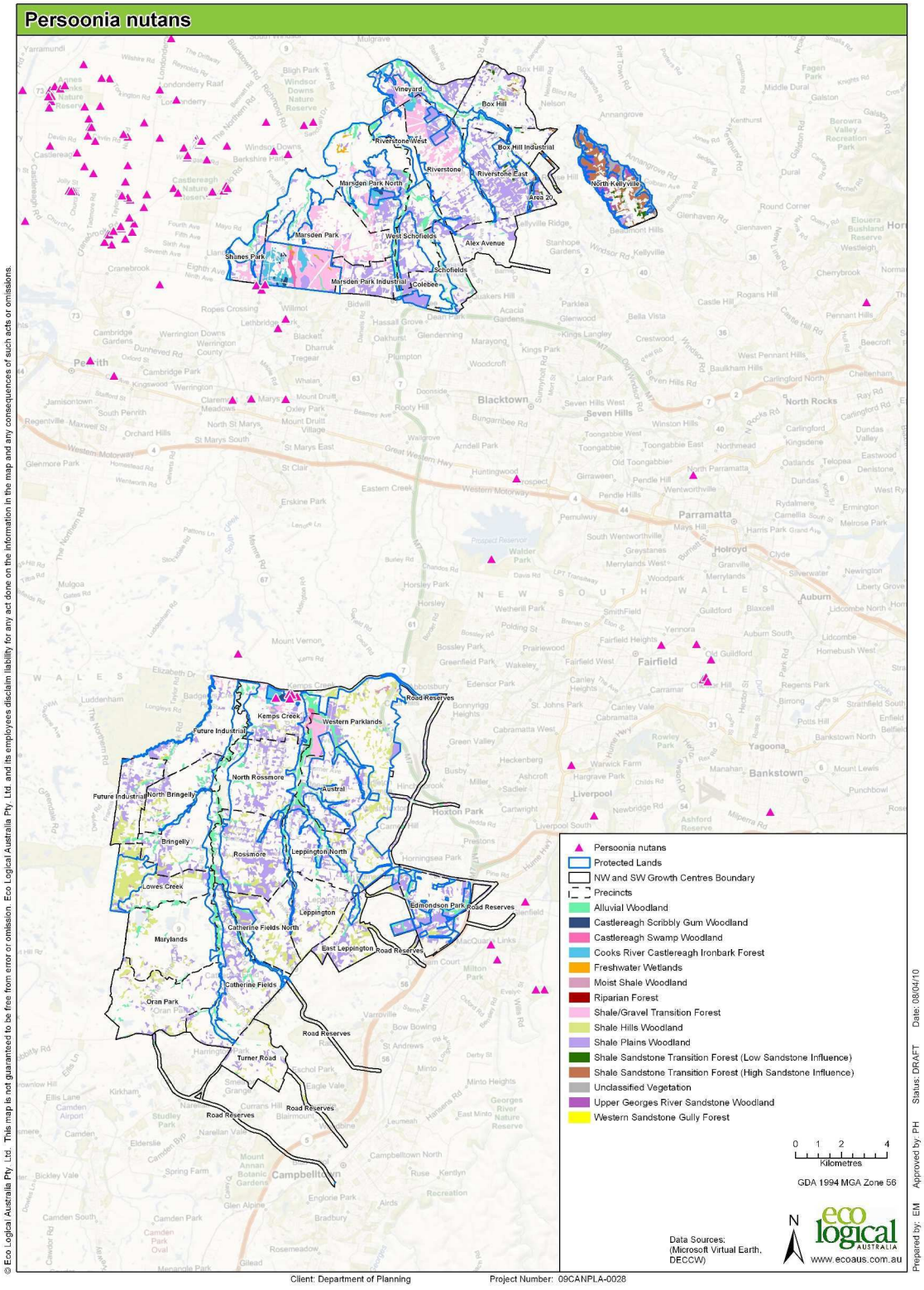

Figure 50: Species distribution and location of NSW Wildlife Atlas records for *Persoonia nutans* within and surrounding the Growth Centres

5.8.3 POTENTIAL IMPACTS TO *PERSOONIA NUTANS* AS A RESULT OF DEVELOPMENT WITHIN THE GROWTH CENTRES

Direct impacts to known populations of *P. nutans* within the Growth Centres have been avoided.

As shown in Figure 46, the population that occurs at the Christadelphian Heritage School is currently located within a non-certified area adjacent to the Public Recreation – Regional zone. The Program requires that this area be surveyed to verify the presence of *P. nutans* and if confirmed present, protection of the area of suitable habitat will be provided to the satisfaction of DECCW.

Indirect impacts also need to be considered and managed for this area. In general, urban development has the potential to impact adjoining areas of bushland through various edge effects such as:

- the introduction of weeds and exotic species which can outcompete and displace individuals of *P. nutans*;
- the spread of rubbish;
- increased disturbance and trampling from pedestrian access and associated recreational activities;
- runoff from construction containing nutrients, sediments and other pollutants; and
- inappropriate water, sewer and stormwater management leading to erosion.

Due to the presence of potential habitat for *P. nutans* within the Growth Centres in areas that have not been surveyed, additional impacts to the species may occur as a result of development. The extent of these additional impacts is unknown. Within the South West Growth Centre there may be additional impacts to the species within the Kemps Creek Precinct outside of known habitat. However, as discussed in the previous section, it is considered unlikely that there will be additional impacts to any areas of importance to the species in this region.

Within the North West Growth Centre there are areas of suitable habitat that have the potential to support important populations of *P. nutans.* These areas are most likely to occur within land zoned for Environment Conservation within the Air Services Australia site at Shanes Park and within the Marsden Park North Precinct. These areas are already afforded protection and therefore any impacts to suitable habitat within these areas will be avoided or minimised. There is also potential for *P. nutans* to occur in the Riverstone/Vineyard area amongst remnants of Cooks River Castlereagh Ironbark Forest grading into Shale Gravel Transition Forest, where known records for *P. parviflora* occur. This area will be impacted by development within the certified lands.

5.8.4 PROPOSED MEASURES TO PREVENT, MITIGATE AND MANAGE POTENTIAL IMPACTS TO *PERSOONIA NUTANS*

The key measure to prevent, mitigate and manage potential impacts to *P. nutans* is the retention and protection of habitat supporting one of the two important populations known to occur within the Growth Centres. These populations both occur within the Kemps Creek Precinct. It is considered unlikely that additional important areas other than those identified through the NSW Wildlife Atlas records exist within the South West Growth Centre.

Direct impacts to these important populations have been minimised or avoided. They have each been afforded a level of protection through the Program, ensuring a positive net outcome compared with the status quo.

POPULATION AT THE CHRISTADELPHIAN HERITAGE SCHOOL

The population that occurs at the Christadelphian Heritage School is currently located within a non-certified area adjacent to the Public Recreation – Regional zone. The Program requires that this area be surveyed to verify the presence of *P. nutans* and if confirmed present, protection of the area of suitable habitat will be provided to the satisfaction of DECCW.

POPULATION WEST OF THE KEMPS CREEK PRIMARY SCHOOL

There will be no direct impact to the population that occurs west of the Kemps Creek Primary School within the Kemps Creek Precinct. This population will be protected and provided with on-going security through zoning as Public Recreation – Regional which triggers acquisition by the NSW Government.

Indirect impacts to this population will be actively managed to minimise and avoid degradation which can result when there are environmentally sensitive lands adjoining urban areas.

POTENTIAL HABITAT WITHIN THE NORTH WEST GROWTH CENTRE

Within the North West Growth Centre, additional areas of potential importance for *P. nutans* may occur within three areas. Impacts to two of these areas (the Air Services Australia site at Shanes Park and the Environment Conservation land within the Marsden Park North Precinct) will be minimised and they will both be provided with protection through zoning as Environment Conservation and will be purchased by or transferred to the NSW Government for conservation purposes.

Indirect impacts to these areas will be actively managed for the protection of the two known threatened flora species that occur there, including *P. parviflora* and *M. minutiflora.* These measures will help to manage potential degradation to suitable habitat for *P. nutans* which can result when there are environmentally sensitive lands adjoining urban areas.

5.8.5 PROPOSAL TO OFFSET POTENTIAL IMPACTS TO *PERSOONIA NUTANS*

There will be no direct impact to known individuals of *P. nutans* within the Growth Centres. There may however, be some residual impacts to potential habitat for the species as a result of development. These residual impacts relate to the loss of potentially suitable habitat within the Riverstone/Vineyard area to the north of the North West Growth Centre.

To date, one property has been purchased through the Growth Centres Offset Program which is thought to support a population of *P. nutans.* This population occurs on the Cranebrook site, located southwest of Castlereagh Nature Reserve. At this site, around 31 plants have been recorded (Eco Logical Australia 2007).

The security of this population in a reserve system is considered to adequately compensate for the potential residual impacts of development within the Growth Centres.

5.8.6 CONSERVATION OUTCOME FOR *PERSOONIA NUTANS*

The Growth Centres support two important populations of *P. nutans,* both of which occur within the South West Growth Centre in the Kemps Creek Precinct.

There are some additional areas of potential habitat for *P. nutans* throughout the Growth Centres. While these areas of potential habitat are not expected to support important populations within the South West Growth Centre, there is some potential for areas within the North West Growth Centres to contain important populations despite a lack of records in this area.

Overall, the Program is expected to deliver a positive net outcome for *P. nutans.* Both known populations are afforded protection and on-going management, as are two of the three areas within the North West Growth Centre identified as potentially important habitat. In the absence of this protection, each of these populations (identified as important to the species' conservation) and areas of suitable habitat would be at risk of serious decline and habitat degradation from adjoining urban areas and potential future development.

There is still expected to be some level of impact to potential habitat for *P. nutans* as a result of development within the Growth Centres. It is considered that these potential impacts have been more than adequately offset through the purchase of the Cranebrook site, which is known to contain a population of *P. nutans.*

CONSISTENCY WITH THE APPROVED RECOVERY PLAN FOR PERSOONIA NUTANS

There is currently an approved recovery plan for *P. nutans* which was prepared in accordance with the NSW TSC Act and the EPBC Act (DEC 2006a).

The conservation activities and outcomes for this species that will occur as a consequence of the Program are not inconsistent with this recovery plan. The Program will specifically contribute to the delivery of two of the recovery objectives of the Plan, which are: *"To minimise the loss and fragmentation of P. nutans habitat using land-use planning mechanisms; and to identify and minimise the operation of threats at sites where P. nutans occurs".*

5.9 PIMELEA SPICATA

5.9.1 SPECIES DESCRIPTION

Pimelea spicata is a low spreading shrub with white flowers often tinged with pink. It is listed as endangered under both the Commonwealth EPBC Act and the NSW TSC Act.

P. spicata has a scattered distribution in two disjunct areas, including the Cumberland Plain in Western Sydney and the coastal Illawarra region south of Sydney. The draft Recovery Plan for the species identifies 30 known extant populations of *P. spicata*, including 25 within the Cumberland Plain, and five within the Illawarra coastal region (DEC 2006b). However, a number of these populations will have been subsequently impacted by development.

In both the Cumberland Plain and Illawarra environments this species is found on well-structured clay soils. On the Cumberland Plain, it is found in Shale Hills Woodland, Shale Plains Woodland as well as degraded sites that would have once supported these vegetation types. In the coastal Illawarra it occurs commonly in Coast Banksia Open Woodland with a better developed shrub and grass understorey (DEC 2005t).

The main threats to the species are habitat loss through vegetation clearing and disturbance. Invasion of habitat by exotic plants is also a key threat to the survival of *P. spicata*.

5.9.2 *PIMELEA SPICATA* WITHIN THE GROWTH CENTRES

There are five NSW Wildlife Atlas records for *P. spicata* within the Growth Centres, occurring in both the North West and South West Growth Centres (see Figure 51). Four of these records comprise an important population for the species. This population occurs at Denham Court Road in the East Leppington Precinct within the South West Growth Centre.

The fifth NSW Wildlife Atlas record for *P. spicata* occurs within the North West Growth Centre in the Alex Avenue Precinct, west of Hambledon Road. However, surveys in 2008 validating this record were unable to locate the species. The area in which the species was previously recorded was observed to be under grazing pressure from horses, and as such, made verification of the presence of the species difficult (GHD 2008).

Within the North West and South West Growth Centres, key potential habitat for *P. spicata* is associated with Shale Hills Woodland, Shale Plains Woodland and Moist Shale Woodland (pers comm. Teresa James, 19 March 2010). These vegetation types are present throughout both Growth Centres and there is potential for the species to occur in areas of remnant vegetation that have not been surveyed. As a result, the Atlas records for this species are not considered to provide a strong representation of its potential occurrence within the Growth Centres.

While potential habitat exists, it is considered unlikely for the species to occur broadly within the Growth Centres given that:

- the species has a relatively scattered distribution within the Cumberland Plain and the majority of known populations support small numbers of individuals (DEC 2005t); and
- the proportion of known *P. spicata* records within the Growth Centres is low.

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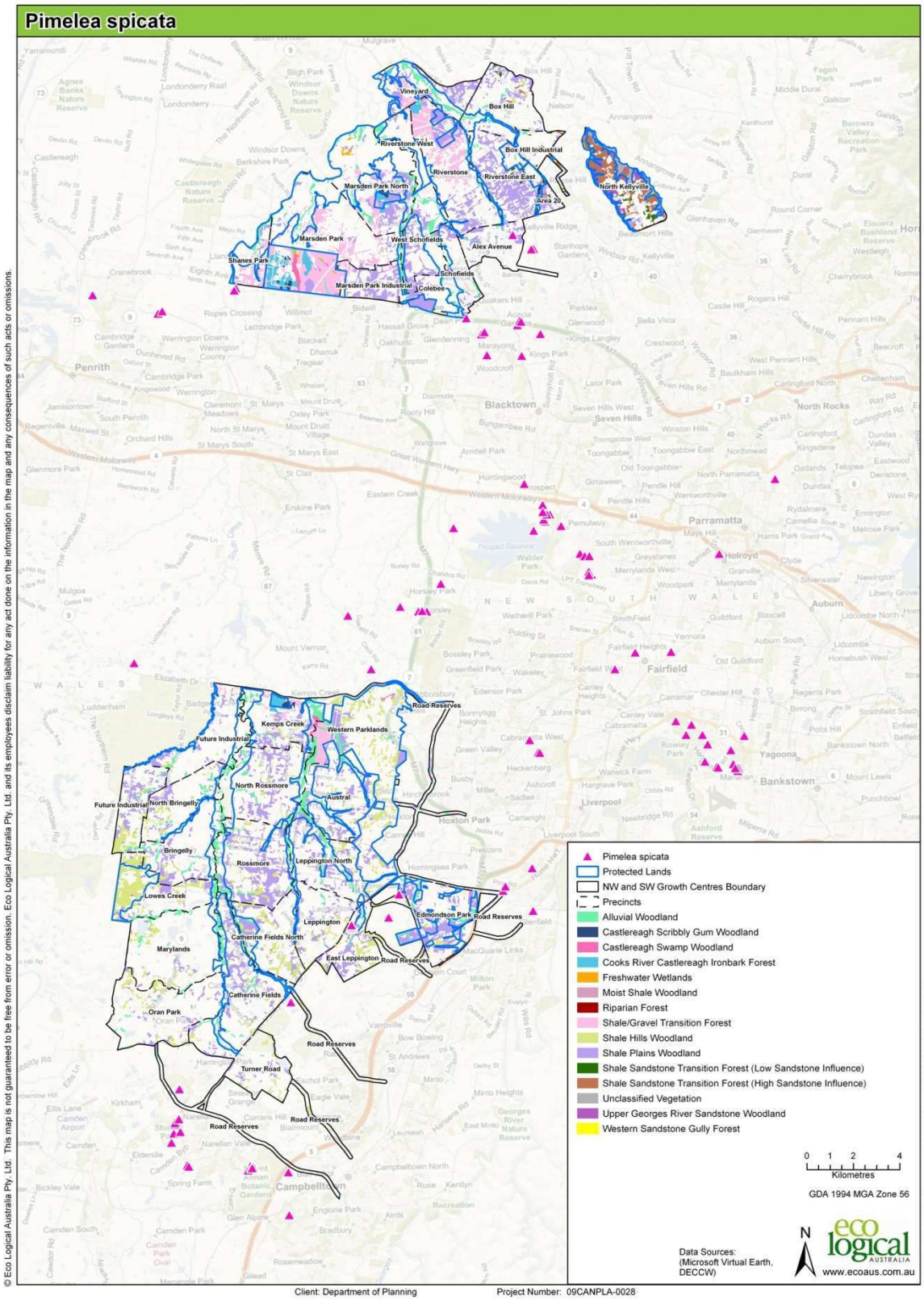

Figure 51: Species distribution and location of NSW Wildlife Atlas records for *Pimelea spicata* within and surrounding the Growth Centres

5.9.3 POTENTIAL IMPACTS TO *PIMELEA SPICATA* AS A RESULT OF DEVELOPMENT WITHIN THE GROWTH CENTRES

The important population of *P. spicata* at Denham Court Road occurs within a non-certified area in the South West Growth Centre. Relevant Biodiversity Measure 17 requires that this site be surveyed during precinct planning, and if the species is confirmed to be present an area of suitable habitat must be protected to the satisfaction of DECCW. It is considered that potential impacts to this population will be avoided based on the implementation of the Relevant Biodiversity Measures.

Potential impacts to the species in other areas of the Growth Centres are difficult to estimate. Given that the NSW Wildlife Atlas records are not likely to provide a strong representation of potential habitat and that suitable vegetation types are present within areas to be developed, some level of impact (which cannot be quantified) from development within the Growth Centres is considered likely to occur.

Again, the scale of these potential impacts is considered to be moderated to an extent by the ecology of the species which indicates that the proportion of the species within the Growth Centres is low.

5.9.4 PROPOSED MEASURES TO PREVENT, MITIGATE AND MANAGE POTENTIAL IMPACTS TO *PIMELEA SPICATA*

The key mechanism for avoiding impacts to the known records of *P. spicata* within the Growth Centres is the implementation of the Relevant Biodiversity Measure for the Denham Court Road population.

In relation to potential habitat, it is considered that other mechanisms within the Program have the potential to provide a benefit to the species. Given that the key vegetation types for the species within the Growth Centres (Shale Hills Woodland and Shale Plains Woodland) are components of EPBC listed Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest, it is considered likely that mechanisms that will provide a benefit for the ecological community may also benefit *P. spicata*. As is the case for potential impacts, these potential benefits cannot be quantified.

The mechanisms relate to the protection of native vegetation and include:

- the retention and protection of existing native vegetation (minimum of 2,000 ha) within the Growth Centres; and
- the more specific protection and management of conservation areas (such as the Kemps Creek Nature Reserve).

As discussed in Section 4.2.2, these two mechanisms will result in the protection of 710 ha of High and Moderate Management Viability Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest within the Growth Centres. While the presence of *P. spicata* within these areas is unknown, they will incorporate areas of potential habitat for the species which will be retained and in relation to the conservation areas actively managed.

It is considered that the measures to protect the known records will provide appropriate protection for those records, and that broader conservation measures within the Growth Centres are likely to provide some level of protection for the species. However, it is also recognised that impacts to potential habitat are likely.

5.9.5 PROPOSAL TO OFFSET POTENTIAL IMPACTS TO *PIMELEA SPICATA*

Due to the likely residual impacts to *P. spicata*, offsets for this species within the Cumberland Plain are considered to be appropriate. Offsets have the potential to provide a significant long term benefit by increasing the number of known sites in conservation areas. At present, only a few known sites occur

within conservation reserves and the draft recovery plan for the species identifies the addition of further sites as a key priority (DEC 2004).

The Program provides for a $530 million biodiversity offsets package to protect high conservation value areas both within and outside the Growth Centres. 70% of $397.5 million (in 2005/06 dollars) will be prioritised to secure high quality vegetation remnants with similar ecological values outside the Growth Centres with a particular focus on the conservation of matters of national environmental significance. As a first preference, these funds will be directed towards identified priority lands across the Cumberland Plain. The NSW Government will ensure that a component of this funding is allocated to protect likely habitat for EPBC threatened flora, including offset areas for *P. spicata.*

5.9.6 CONSERVATION OUTCOME FOR *PIMELEA SPICATA*

Both known and potential habitat for *P. spicata* occur within the Growth Centres. Potential habitat is linked to the presence of Shale Hills Woodland and Shale Plains Woodland (components of EPBC listed Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest).

The Program provides for the protection of the known important population within the South West Growth Centre. However, some level of impact (which cannot be quantified) to potential habitat within the Growth Centres is considered likely to occur. The scale of these potential impacts is considered to be moderated by the fact that:

- the species has a relatively scattered distribution within the Cumberland Plain and the majority of known populations support small numbers of individuals (DEC 2004); and
- the proportion of known *P. spicata* records within the Growth Centres is low.

Given that some level of residual impact is expected, offsets that increase the number of known sites of *P. spicata* in conservation are considered to be appropriate. Based on the protection of known records and areas of potential habitat within the Growth Centres, as well as the allocation of offset funding to protect likely habitat for *P. spicata*, the conservation outcome for the species is considered to be appropriate.

CONSISTENCY WITH THE APPROVED RECOVERY PLAN FOR PIMELEA SPICATA

There is currently an approved recovery plan for *P. spicata* which was prepared in accordance with the NSW TSC Act and the EPBC Act (DEC 2006b).

The conservation activities and outcomes for this species that will occur as a consequence of the Program are not inconsistent with this recovery plan. The Program will in fact contribute to the delivery of two of the recovery objectives of the Plan, which are: *"To conserve P. spicata using land-use and conservation planning mechanisms; and to identify and minimise the operation of threats at sites where P. spicata occurs."*

5.10 PULTENAEA PARVIFLORA

5.10.1 SPECIES DESCRIPTION

Pultenaea parviflora is a small erect branching shrub, generally less than 1 metre high with yellow, pea-like flowers. It is listed as vulnerable under the Commonwealth EPBC Act and endangered under the NSW TSC Act.

This species is endemic to the Cumberland Plain, with a core distribution from Windsor to Penrith and east to Dean Park. An analysis of all records for this species was undertaken as part of the preparation for the Draft Cumberland Plain Recovery Plan (DECCW 2009b). For the purposes of the analysis, populations were delineated by geographic discontinuities of over one kilometre between reliable records and sites were delineated by geographic discontinuities of over 200 metres between reliable records. The analysis identified 82 sites comprising 30 populations of *P. parviflora*. 15 sites from eight populations occur in formal conservation reserves.

A number of outlier populations have been previously recorded from Kemps Creek and Wilberforce (DECC 2005c). A large population is also present within the recently purchased Cranebrook site where 4,309 individuals have been recorded with an overall estimate of the population at that site being between 86,000 and 127,000 individuals.

Habitat for *P. parviflora* occurs within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays. It is also known to occur in areas of Castlereagh Scribbly Gum Woodland which adjoin the above mentioned vegetation communities (DEC 2005c). Flowering of *P. parviflora* occurs between August and November with a peak in September (Benson and McDougall), however flowering is largely dependent on suitable environmental conditions (DEC 2005c).

The main threats to this species include clearance and fragmentation of habitat for residential, industrial and rural purposes, inappropriate fire regimes, uncontrolled vehicular access, fill and rubbish dumping and weed invasion (DEC 2005c).

5.10.2 *PULTENAEA PARVIFLORA* WITHIN THE GROWTH CENTRES

There are numerous NSW Wildlife Atlas records for *P. parviflora* within both the North West and South West Growth Centres (see Figure 52).

In the North West Growth Centre there are four reliably recorded populations comprising nineteen records. These include:

- one population within the certified areas in the Riverstone Precinct (plant numbers not recorded);
- one population which straddles the two precincts of Schofields and Alex Avenue and contains at least 2,500 individuals;
- one population within the Air Services Australia site at Shanes Park (plant numbers not recorded); and
- one population, which occurs within the non-certified area to the south of the Colebee Precinct and contains at least 5,000 plants.

Surveys for threatened flora within the Riverstone Precinct of the North West Growth Centre, verified the presence of the species in the north of the precinct as well as identifying a number of new populations (GHD 2008). The new populations were found to be interspersed with *Grevillea juniperina*

subsp. *juniperina* within intact Shale Gravel Transition Forest. A population in excess of 500 individuals was found on Camberwell Street in the north of Riverstone. Another population of approximately 55 individuals was found on Otago Street, Riverstone (GHD 2008).

In the South West Growth Centre there are three reliably recorded populations. These include:

- two populations within the Kemps Creek Precinct including one population of around 950 plants which occurs within and around the land zoned for Public Recreation – Regional and one population comprising a single plant recorded which occurs within the certified land to the south of the precinct; and
- one population within the certified area of the North Rossmore Precinct. The record for this population dates from 1999 it is unlikely that the species persists at this site as the site was entirely cleared sometime prior to 2007 and there is no longer any intact habitat present.

Within both the North West and South West Growth Centres, key habitat for *P. parviflora* is associated with Castlereagh communities and Shale Gravel Transition Forest, which predominantly occur in the North West Growth Centre (pers comm. Teresa James, 19 March 2010). Marginal habitat is associated with particular areas of Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest occurring on localised lateritic gravel in both the North West Growth Centre and the South West Growth Centre (pers comm. Teresa James, 19 March 2010). Generally this marginal habitat is more restricted and supports smaller populations than key habitat.

While targeted surveys have not been undertaken throughout the Growth Centres, the NSW Wildlife Atlas records for the species appear to adequately identify the key or important habitat areas. In the South West Growth Centre, suitable habitat for *P. parviflora* is generally confined to the Kemps Creek region where there are localised occurrences of lateritic gravels and intact areas of Shale Gravel Transition Forest, Castlereagh Scribbly Gum Woodland and Cooks River Castlereagh Ironbark Forest. As outlined above, a number of records exist for this area, including one population of around 950 plants. There is some potential for the species to occur in isolated areas within and around Kemps Creek Precinct that have not been surveyed. However, the potential for additional important areas to be identified is considered to be limited.

In the North West Growth Centre, key areas of suitable habitat occur within the remnants of Shale Gravel Transition Forest at the Air Services Australia site, the Marsden Park North Precinct and the Riverstone Precinct; within the remnants of Castlereagh Scribbly Gum Woodland and Cooks River Castlereagh Ironbark Forest at the Air Services Australia site at Shanes Park, the Marsden Park North Precinct, the Riverstone Precinct and Vineyard; and within an area (shown as Shale Plains Woodland on Figure 52) associated with lateritic gravel and patches of tertiary alluvium adjacent to the Colebee Precinct (NPWS UBBS). These areas are identified as known habitat through existing records in the NSW Wildlife Atlas for this species. Based on these habitat characteristics, there is some potential for the species to occur within unsurveyed areas around the Colebee/Schofields area and the north Riverstone/Vineyard area. However, as with the South West Growth Centre, the important areas for the species within the North West Growth Centre are thought to be well represented through the NSW Wildlife Atlas records and there is considered to be limited potential for additional important areas to be identified.

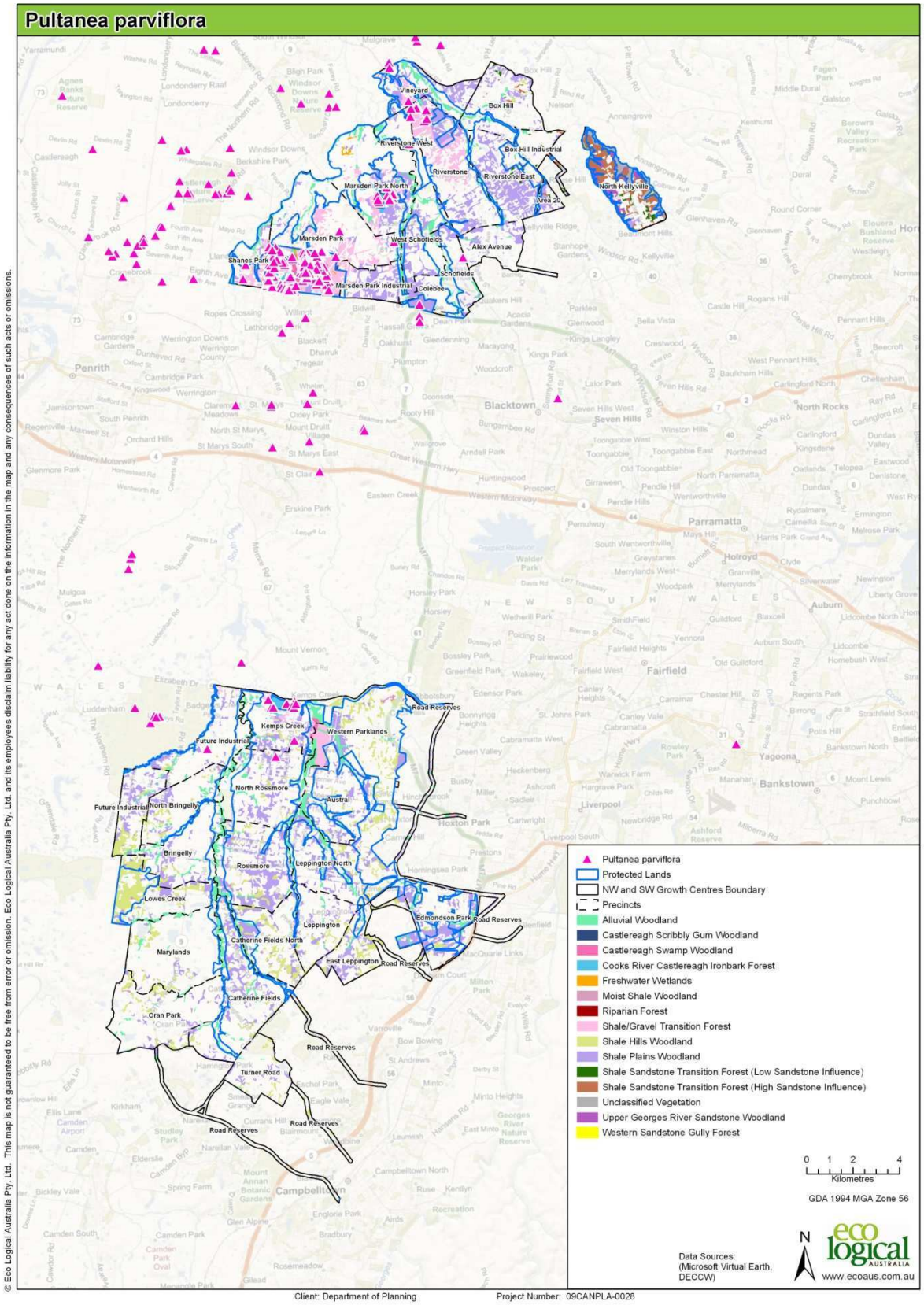

Figure 52: Species distribution and location of NSW Wildlife Atlas records for *Pultenaea parviflora* within and surrounding the Growth Centres

5.10.3 POTENTIAL IMPACTS TO *PULTENAEA PARVIFLORA* AS A RESULT OF DEVELOPMENT WITHIN THE GROWTH CENTRES

Across the Growth Centres, the following direct impacts to *P. parviflora* are expected:

- Loss of the population within the north of the Riverstone Precinct in the North West Growth Centre;
- Loss of a component of the population within the Marsden Park North and Schofields Precincts.
- A large component (500 plants) of the Kemps Creek population is within and around the area zoned for Public Recreation – Regional. A second component (400 plants) of the population is located within the non-certified area (subject to further investigation for *Acacia pubescens*). The Program requires that this area be surveyed to verify the presence of *P. parviflora* and if confirmed present, protection of the area of suitable habitat will be provided to the satisfaction of DECCW. A further component (50 plants) occurs within certified land and is therefore expected to be lost as a result of development. The three reliable records for this population are shown in Figure 46.
- Loss of the second population within the Kemps Creek Precinct where only a single plant was recorded.

The remaining known records for *P. parviflora* are located within areas zoned to retain and protect their environmental values (that is, areas zoned for Environment Conservation and Public Recreation – Regional). Thus direct impacts to these plants are not expected. However, indirect impacts to these populations from development within the Growth Centres will need to be considered and managed. In general, urban development has the potential to impact adjoining areas of bushland through various edge effects such as:

- the introduction of weeds and exotic species which can outcompete and displace individuals of *P. parviflora*;
- the spread of rubbish;
- increased disturbance and trampling from pedestrian access and associated recreational activities;
- runoff from construction containing nutrients, sediments and other pollutants; and
- inappropriate water, sewer and stormwater management leading to erosion.

Due to the presence of potential habitat for the *P. parviflora* in areas that have not been surveyed within the Growth Centres, additional impacts to the species may occur as a result of development. The extent of these additional impacts is presently unknown. However, as discussed in the previous section it is considered unlikely that additional important areas exist.

5.10.4 PROPOSED MEASURES TO PREVENT, MITIGATE AND MANAGE POTENTIAL IMPACTS TO *PULTENAEA PARVIFLORA*

The key measure to prevent, mitigate and manage potential impacts to *P. parviflora* is the retention and protection of habitat supporting populations known to occur within the Growth Centres. These include the populations within the Marsden Park North Precinct, the Air Services Australia site at Shanes Park, the area adjacent to the Colebee Precinct and the area within the Kemps Creek

Precinct. It is considered unlikely that additional important areas to those identified through the NSW Wildlife Atlas records exist.

Direct impacts to the majority of plants within these populations have been minimised or avoided. They have each been afforded a level of protection through the Program, ensuring a positive net outcome compared with the status quo.

MARSDEN PARK NORTH PRECINCT

There will be minimal impact to the Marsden Park North population with the majority (over 2,500) of plants retained, protected and managed. The protection and on-going security for this population is enabled through zoning as Environment Conservation, which triggers acquisition by the NSW Government. This land is currently being acquired by the NSW Government using funding separate to the Conservation Fund.

Indirect impacts to this population will be actively managed to minimise and avoid degradation which can result when there are environmentally sensitive lands adjoining urban areas.

AIR SERVICES AUSTRALIA SITE AT SHANES PARK

There will be no direct impacts to the population within the Air Services Australia site at Shanes Park. Similar to the Marsden Park North population, this population will be protected and provided with on-going security through zoning as Environment Conservation.

Indirect impacts to this population will be actively managed to minimise and avoid degradation which can result when there are environmentally sensitive lands adjoining urban areas.

AREA ADJACENT TO THE COLEBEE PRECINCT

The large population (over 5,000 plants) that occurs on land adjacent to the Colebee Precinct will be retained in an existing conservation area purchased by the RTA for transfer to DECCW as part of the M7/Westlink Motorway offsets.

KEMPS CREEK PRECINCT

While there will be some loss of plants (around 50 plants) within the certified area of the Kemps Creek Precinct, the majority (at least 500 plants) of the large population of *P. parviflora* that occurs towards the north of the Kemps Creek Precinct will be retained, protected and managed.

The protection and on-going security for this population is enabled through zoning as Public Recreation – Regional which triggers acquisition by the NSW Government.

A further component (over 400 plants) of the population is also thought to occur within the non-certified area adjacent to the Public Recreation – Regional zone. The Program requires that this area be surveyed to verify the presence of *P. parviflora* and if confirmed present, protection of the area of suitable habitat will be provided to the satisfaction of DECCW.

Indirect impacts to this population will be actively managed to minimise and avoid degradation which can result when there are environmentally sensitive lands adjoining urban areas.

5.10.5 PROPOSAL TO OFFSET POTENTIAL IMPACTS TO *PULTENAEA PARVIFLORA*

There are likely to be some residual impacts to *P. parviflora* as a result of development within the Growth Centres. These residual impacts relate to the loss of the known population within the north of the Riverstone Precinct and the loss of areas of potential habitat around the Colebee/Schofields area, the Riverstone/Vineyard area and the Kemps Creek area.

To date, one property has been purchased through the Growth Centres Offset Program which supports a very large and significant population of *P. parviflora.* As mentioned previously, this population occurs on the Cranebrook site, located southwest of Castlereagh Nature Reserve. At this site, it is estimated that the population consists of 86,000 and 127,000 individuals plants.

The security of this population in a reserve system is considered to adequately compensate for the known and potential residual impacts of development within the Growth Centres.

Furthermore, there are significant *P. parviflora* populations in the potential investment areas, including some with numbers >1,000 individuals. There are also extensive areas of potential habitat (Growth Centres Commission 2007).

5.10.6 CONSERVATION OUTCOME FOR *PULTENAEA PARVIFLORA*

The Growth Centres support a number of known populations of *P. parviflora.*

Within the North West Growth Centre, four populations have been recorded in the NSW Wildlife Atlas. These include one within the Marsden Park North Precinct, one within the Riverstone Precinct, one within the Air Services Australia site at Shanes Park and one within the area adjacent to the Colebee Precinct. Surveys identified two further populations in the Riverstone Precinct (GHD 2008)

Within the South West Growth Centre, two populations occur in the Kemps Creek Precinct (although one population consists of only one recorded individual).

While there are additional areas of suitable habitat within the Growth Centres that have not been surveyed, it is considered unlikely that any additional important populations occur in these areas.

The Program is expected to deliver a positive net outcome for *P. parviflora.* Direct impacts to four known areas supporting populations are effectively avoided. One of these populations (the population on land adjacent to the Colebee Precinct) is already protected through existing conservation provisions. The remaining three populations are afforded protection and on-going management. In the absence of this protection, each of these populations would be at risk of serious decline and habitat degradation from adjoining urban areas and potential future development.

Despite these measures, there will be some level of impact to *P. parviflora* as a result of development within the Growth Centres. These impacts relate to the loss of the known populations within the north Riverstone Precinct and a small portion of the Kemps Creek population, and the loss of areas of potential habitat around the Colebee/Schofields area, the Riverstone/Vineyard area and the Kemps Creek area. It is considered that these known and potential impacts have been more than adequately offset through the purchase the Cranebrook site, which supports a very large population of *P. parviflora.*

CONSISTENCY WITH THE DRAFT CUMBERLAND PLAIN RECOVERY PLAN

There is currently a draft recovery plan for the Cumberland Plain which addresses *P. parviflora* as a component of the threatened biodiversity on the Cumberland Plain (DECCW 2009b).

The conservation activities and outcomes for this species that will occur as a consequence of the Program are not inconsistent with this draft recovery plan.