BALLINA SHIRE COUNCIL

SEPARATE ATTACHMENT (ATTACHMENT 2)

TO ITEM 11.2

FIG TREE MANAGEMENT

Ordinary meeting 25/1/12

balina
shire council

Fig Trees located in Bentinck Street (close to theOne Stop Shop)
Condition of Trees following the Installation of Root Barrier

Figure 1: Bentinck Street Figs showing difference in canopy density between root severed trees and undisturbed trees

This photo shows the difference in Canopies between the trees (on Left) that were subjected to the installation of the root barrier, and those that are on the other side of the street.

Note also (Red Arrow's) the large amount of tip dieback. This tip dieback is usually related and identified as resulting from root issues and is a significant symptom in assessing trees.

In this case it is as a result of the severe root pruning that was necessary to enable the installation of the Bentinck Street root barrier.

This image shows the density of the canopy of the undisturbed trees on the opposite side of the street to the root barrier. Crown density of this tree is estimated at approximately 90% and the canopy is considered to be intact and in good condition.

Figure 2: Crown density of undisturbed trees on northern side of street app 90% canopy density

Figure 3: Crown density of trees on southern side of street (root barrier) app 30% canopy density

This image shows the same angled photograph taken from directly beneath the tree opposite to that shown in Figure 2.

This tree has suffered severe root severance, and has an estimated crown density of 30%. The loss of leaves is the tree's response to reduction in root mass and has dramatic effects on the photosynthetic rate of the tree and ultimately results in reduced energy production and a decrease in defence mechanisms within the tree's structure.

This image shows the comparison between the trees (right) that were not subjected to the severe impacts of root barrier installations, as opposed to those trees (left) that were.

The trees are of the same species and age and have been identified as *Ficus microcarpa var. Hillii*

Figure 4: Comparison between trees subjected to root severance from root barrier installation and those that were undisturbed

This image shows again the comparison in regards to canopy density of the undisturbed trees on the opposite side (right) of the street, to those on the side (left) where the root barrier was installed and severe root severance occurred.

PLEASE NOTE: these trees were of similar crown density prior to the installation of the root barrier and subsequent root severance.

Figure 5: Further evidence of the Comparison between trees subjected to root severance from root barrier installation and those that were undisturbed

BALLINA SHIRE COUNCIL

SEPARATE ATTACHMENT (ATTACHMENT 3)

TO ITEM 11.2

FIG TREE MANAGEMENT

Ordinary meeting 25/1/12

51 Bentinck Street – Ballina
Ficus microcarpa var. Hillii- Root Encroachment report

Glenn Hargrave Dip- Arb

Ballina Shire Council –June 2011

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Introduction

The purpose of this report is to outline ongoing problems with root encroachment of a Ficus microcarpa var. Hillii located in the road reserve immediately in front of 51 Bentinck Street, Ballina. The issues with the tree have been under investigation for some time now and the concerns of the residents are growing in relation to damage to their property as a result of root encroachment. There are also concerns for the inundation of their property due to blocked roadside guttering drainage and blocked stormwater drainage.

Several avenues have been investigated and the matter has been reported to Graham Brown (Team Leader of Roads maintenance) in regards to stormwater issues and potential upgrading of stormwater. To date no action has been taken.

This report investigates and identifies issues along with associated costs for proposed actions.

Methodology

The tree was again inspected and assessed by Councils Arborist on the 23 June 2011, using industry recognised visual tree assessment techniques and principles. This inspection has identified a number of root encroachment issues and threats to both private property and Council infrastructure.

Tools

Richter Diameter tape

Hagloff height meter

Thor 710 Sounding Hammer

Observations

Species: Ficus microcarpa var. Hillii

DBH: 3.11m

Age: Mature

Height: 12.9m

Condition:
Tree is in a relatively healthy condition with what appears to be good vigour and health.

The tree is co-dominant with 1 main leader and a second smaller leader on the western side of the trunk

Photo 1: Ficus microcarpa var. Hillii- 51 Bentinck Street Ballina

The co-dominant stems have a minor inclusion at the branch union which is consistent with this species

The trees crown is asymmetric with approximately 80% of its crown extending over Bentinck Street, Ballina

The proportion of canopy extending towards the mentioned property is under overhead service lines and as such has been subject to extensive and multiple pruning events.

There is an amount of sun scalding damage on the upper surface of exposed branches as a result of poorly timed overhead service line clearance.

The largest visible extent of the subject tree's primary scaffolding roots extends north wards towards the McCulloch property (51 Bentinck St.).

Several large (primary scaffolding) surface roots were observed extending into the gutter (roadside guttering has been damaged) as well as extending across nature strip fracturing concrete footpath and also extending through into the property.

Tree is growing in severely compacted soil in close proximity to the Bentinck street roadway.

Photo 2: Shows extent of large roots to the north, as well as cracked footpath

Discussion

In January 2011 the owner of the property called Council to report that during heavy rainfall backed up by a king tide the subject property had been inundated with water and water levels had almost reached a height to enter the property. An inspection was carried out and determined that severe root encroachment had blocked the grate of a small stormwater pit located immediately adjacent to the tree. Water was observed to not be flowing through any adjacent drains. The grate was lifted and large sections of tree roots were removed from the drain. This immediately resulted in water movement and water levels began to recede.

In 2009 the owners of the property, contacted Council in regards to tree roots encroaching into stormwater down pipes at the rear of the dwelling some 20m from the subject tree. An onsite inspection was carried out with Glenn Hargrave and Jillian Pratten. This inspection revealed several locations where tree roots from the subject tree were identified to be interfering with pipes and had caused lifting of paving within the property.

The option of installing a root barrier was investigated and at first thought it was determined that this was a plausible option however, after the inundation event in January 2011, and subsequent discussions with Graham Brown, it was identified that there were considerations in place to upgrade the stormwater drainage system adjacent to the subject tree. It was stated by Graham that the stormwater pipes when put in were small as the tree was existing at the time of their installation, and it is thought that they do not have adequate capacity to take heavy inflows of stormwater.

The placement of the root barrier in order to comply with Australian Standards AS 4970: 2009 Protection of Trees on Construction Sites would have to be put in place well inside the boundary of the private property. If the root barrier was to be located on public land it is predicted that this would have severe structural impacts on the trees ability to uphold its asymmetric canopy.

As the larger majority of the trees canopy is over the southern plane of the root plate due to continuous pruning for overhead power line clearance, the trees root plate has adapted to form its primary structural roots in the plane of stress to the north. This in turn means that the trees main anchorage root system is under severe tension. As a general consideration of *Ficus spp*, this is not considered to be abnormal as due to their usually large size they have extraordinary capacity to sustain such forces. However if a root barrier is installed it will cause severing of these major roots, on the tension side of the root plate. This loss of structural integrity is expected in combination with the asymmetric crown is expected to place the tree at a potentially high risk of catastrophic failure, which will have potentially serious impacts on the Bentinck roadway users and pose a significant hazard to the general public.

Due to the excessive pruning of the subject tree' northern side of the canopy the tree has developed a very poor branch structure. As a result crown reduction pruning to reduce the asymmetrical crown of the canopy on the southern side (overhanging Bentinck Street), will not be able to be carried out in accordance with AS 4373:2007 Pruning of Amenity Trees. This pruning would need to be severe and in conjunction with severe root loss as the result of root barrier installation will increase the impacts on the tree's health and vitality.

Conclusion

Fig trees in the urban environment are often looked upon, and with just cause as being a major feature of the urban forest. They are often stately and in most cases have historic significance. Fig trees often adapt almost too well to urban pressures and as a result generally thrive where other trees cannot survive. However, to their detriment they are also generally large and when conflict arises between tree' and property, there are not generally many options available to remediate issues of such a large extent.

In regards to the above assessment of this tree it is considered that with the necessary pruning required to restore balance to the tree along with the necessary root severance to install a root barrier the tree will placed under enormous stress and has a high potential to fail in health and die.

With the cost of these methods being carried out and a low chance of survival it is not considered that installation of a root barrier and the then required pruning is a cost effective measure, as its success and long term viability of the tree cannot be guaranteed.

It is therefore considered that in regards to the most cost effective and best outcome to remediate damage caused by this tree, and to eliminate the potential for future damage as a result of root encroachment both to private property and Council infrastructure that this tree be removed in its entirety.

It is the conclusion of this report that the tree be removed with consideration be given to replacing the tree with a more suitable species. In this location the recommendation is to replace the Fig tree with a Melaleuca sp. which is used elsewhere in this area as a street tree.

Recommendations

- That the Fig tree be removed
- That an investigation be further carried out into the adequacy of the stormwater drainage system in this locale.
- That an advanced Melaleuca sp be replanted in this location.

BALLINA SHIRE COUNCIL

SEPARATE ATTACHMENT (ATTACHMENT 4)

TO ITEM 11.2

FIG TREE MANAGEMENT

Ordinary meeting 25/1/12

Tamar St *Ficus spp.* Root Encroachment Report

Ballina Shire Council
20 October 2009: Amended June 2011

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1. Introduction

This report has been compiled in order to investigate and discuss options for the remediation of ongoing issues with root encroachment from the Fig trees (*Ficus benjamina)* growing in the road reserve and the potential structural damage as a result of this encroachment to adjacent buildings located on the northern side of Tamar Street, Ballina between Moon Street and Cherry Street.

Council have received numerous complaints from pedestrians in regards to trips and trip hazards as a result of lifted pavements from roots, along with a number of complaints from property owners in regards to minor damage to buildings and potential structural damage as a result of the above mentioned root encroachment.

As a result of this, this report identifies and discusses options and details recommendations for consideration by council in regards to the remediation of ongoing issues relating to these trees and their associated root systems.

2. Heritage / History

The below section was supplied by Kate Gahan-Cultural Development Officer Ballina Shire Council in regards to the historical significance of these trees

Documentary evidence on the history of these trees is scant. It is understood that the Weeping Figs at the eastern end of Tamar Street, between Cherry and Martin Streets, were planted in 1932, as part of a public tree planted scheme supported by the then Ballina Municipal Council. It is not clearly documented when the trees in Tamar Street, between Cherry and Moon Streets, were planted and why.

After examining existing documentary and photographic sources, it appears that they were likely (an almost certainly) part of a public tree planting scheme undertaken in the late 1930s by Ballina Municipal Council.

The Ballina Municipal Council commenced planting trees in public spaces on 1891, a practice that sought to beautify the (increasing) urban landscape of Ballina. (For reference as to when Ballina Municipal Council commenced planting trees in public spaces see Cliff Murray, Across Three Bridges, pp. 363-364). Public tree planting by Municipal authorities in the era was common, the period from 1890-1910 has been referred to historically as the 'second Municipal Street Tree period'. (See NSW Heritage Office publication, Street Trees in NSW: Guidelines for Conservation and Management, 1990 NSW Department of Planning).

Murray indicates that the Weeping Figs in Martin and Tamar Streets (between Cherry and Martin Streets) were planted in 1932.

> *'The purchase of 48 weeping fig seedlings in September, 1932, was for a planting programme in Tamar Street, between Cherry and Norton Streets and Martin Street between River and Crane Streets.'*

The planting of these trees was one of a number of public tree planting schemes that had taken place from 1891 by Ballina Municipal Council.

Photographic evidence, dating from the late 1930s, of Ballina Island demonstrates trees existing in Tamar Street, from Martin to Tweed Street. In a submission to Council in 2000 by Ballina's BEST Environmental Committee, it is argued that the Weeping Fig trees located between Cherry and Moon Streets were planted as a memorial in the early 1930s. It is suggested the tree's memorial status stemmed from

these being planted at the same time the Digger's Hall (formerly located in Moon Street) was built.

Photographic evidence, however, shows that the figs located between Cherry and Tweed Streets were planted after the Cherry to Martin Street trees (1932). The image also shows that the figs from Cherry to Martin Streets were young, but established trees, before the planting of trees from Cherry to Tweed Streets. This means they were also planted several years after the Digger's Hall was opened/established, and, incidentally, after period of widespread memorial trees plantings. (Refer to NSW Heritage Office publication, Street Trees in NSW: Guidelines for Conservation and Management, 1990 NSW Department of Planning).

Precisely who instigated the planting of trees from Cherry to Tweed Streets is not known at this time. It is known however, that this era remained an era of public tree planting schemes by Ballina Municipal Council. That these trees were a uniform grouping/planting and joined the already extant between Cherry and Martin Street trees demonstrates a deliberate tree planting scheme. It is also interesting to note that these trees lined the bus route that ferried passengers from the Ballina railway station to River Street/town and in an era when tourism in Ballina was growing. This suggests also a deliberate scheme to beautify a now defunct, but then significant, entrance-way to Ballina.

In light of the above, it is noted that these trees can be considered to have local historic heritage values. The heritage value of these trees derives from a deliberate attempt by Ballina Municipal Council/the local community to beautify the town and shape the local urban landscape. This move to beautify Ballina is associated with the historic development of the Ballina urban environment and, likely, the development of local tourism.

3. Location

The trees are located in the road reserve in Tamar Street between the intersections of Tamar / Moon Streets and Tamar and Cherry Streets. The trees of most concern are located on the northern side of Tamar Street at the western end in front of 83 - 77 Tamar Street.

There are a number of underground services in close proximity to the trees including water, Telecommunications (incl. Fibre optic) and electricity, along with high voltage electrical conductors located immediately above the trees on the northern side of Tamar Street.

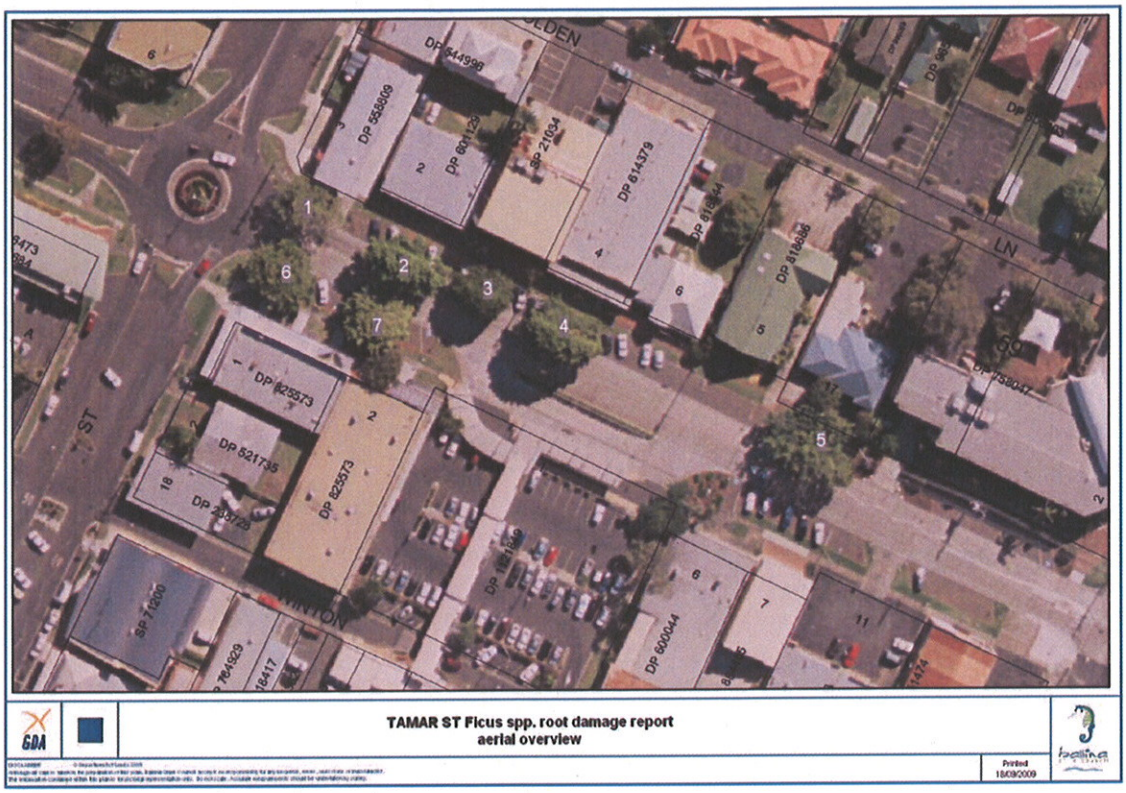
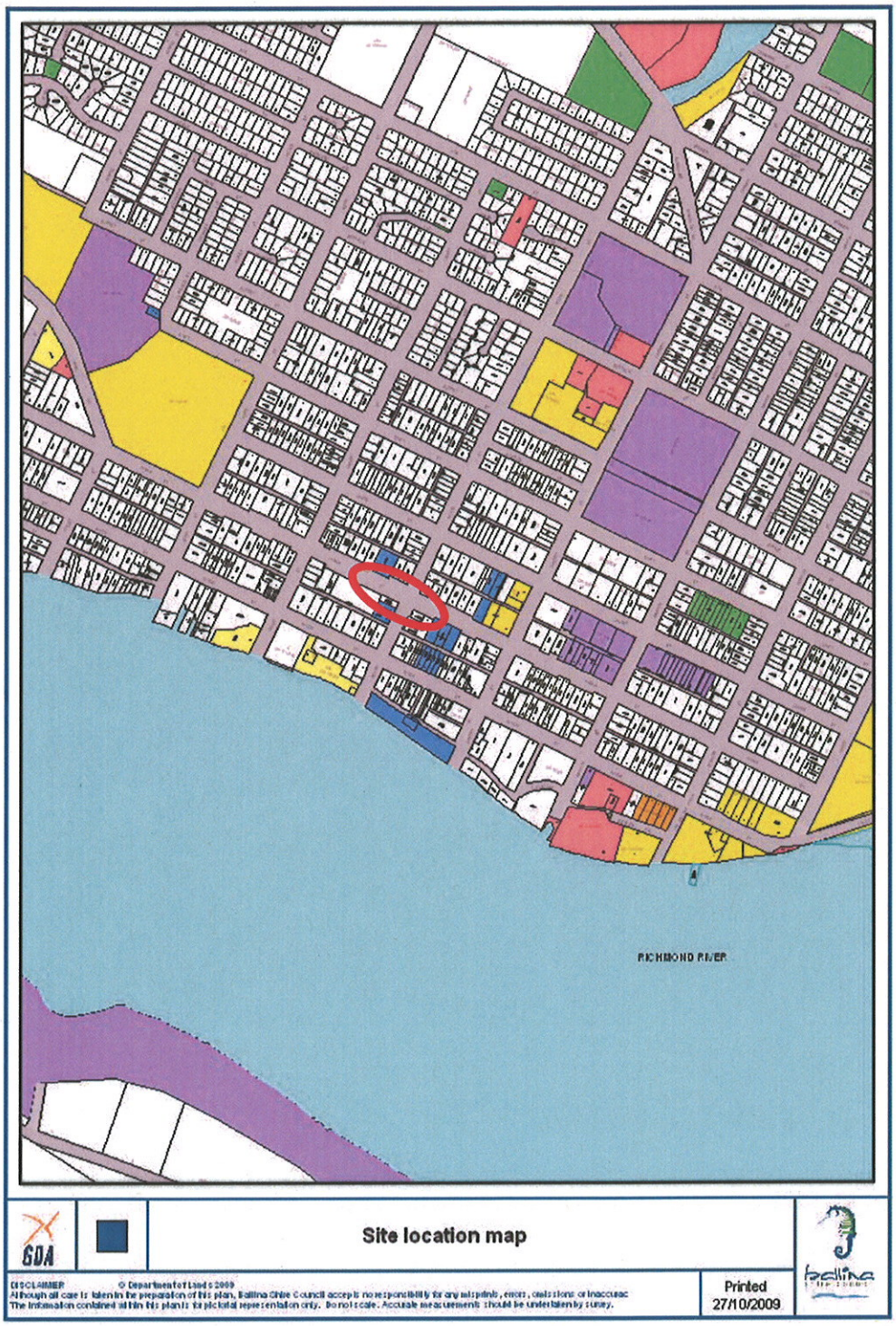


Photo 1 Aerial Image of nominated trees



Map 1 Location of nominated trees (Map of Ballina Island)

4. Service Location

Insert TELSTRA Plans DW Doc No. 1413897 (pg 1) (CABLE PLANS)
Insert TELSTRA Plans DW Doc No. 1413897 (pg 2) (Mains Plan)
Insert Country Energy Plans DW Doc No 1413913

5. Discussion

Services

The trees are located under high voltage power lines and have been subject to regular pruning to clear overhead powerlines.

The number of underground services located in the subject area is quite extensive and are a major impediments to remediation of root encroachment issues caused by these trees. The services limit the options and location of the placement of a root barrier.

Root Barrier Installation

The placement of a root barrier is a remediation option that may be used to reduce root encroachment issues and so prevent damage to properties, whilst keeping the trees in situ.

Flexible root barriers can be highly effective in the redirection and control of root encroachment and are most effective when placed prior to planting. However when installed around established trees after tree roots have become a problem, the installation of the root barriers will affect the tree health to varying degrees depending on the location of trench and distance from trunk.

Root barriers may be prone to incorrect installation and perforation (usually when placed in rocky soils or where services have to be reinstalled and the root barrier is breached) and so are not considered a total elimination measure or to be 100% effective. In the majority of cases the installation of root barriers are considered sufficient enough to have reduced the issue of root damage to an acceptable level.

The installation of root barrier is an expensive process and the impact of the root pruning and disturbance to the tree needs to be considered in terms of the impact of these works on the tree and any shortening of its useful life expectancy.

Tree Health Impacts

The overall condition of the trees is fair to moderate. A general overview of the trees is as follows and the trees would be classed as over mature or sensing trees.

The trees on the northern side of Tamar Street have been subjected to regular pruning for clearance from overhead high voltage electrical lines. This pruning has been ongoing and routine over the life of the trees. The pruning techniques in the past have not been conducive to good plant health and as a result there are extensive areas of decay within the crowns. Along with this all seven of the mentioned trees have been subject to severe lopping and topping and this has also contributed to poor health and an increase in decay.

Council has received numerous complaints in regards to road obstructions from overhanging foliage, root trip hazards and root encroachments but have not received any reports of branch failures.

The impact of the installation of a root barrier in order to stop the encroachment of roots is expected to have a detrimental effect on the long term viability of the trees. The work required to install the root barrier will significantly reduce the roots of the tree and as the trees are maturing and in decline this root loss will impact on the safe useful life expectancy of the trees. Due to the age of the trees they do not have the vigour to recover from impacts such as loss of roots and severe pruning of branches.

6. Remediation Options

Option 1- Installation of Root Barrier

The option of installing a root barrier involves the installation of an impermeable flexible plastic barrier and in this case to a minimum depth of 1500mm. This is carried out using a trenching machine to both dig the trench and sever the tree roots.

Photo 2: Red line indicates the only available position for a root barrier that does not interfere with services. Blue line indicates position that root barrier should be placed to ensure minimal impacts on trees.

In the Tamar Street situation the root barrier should be placed on the northern side of the foot path that runs parallel to the trees (Blue line Photo 2) and would be less detrimental to the health and vitality of these trees, however this would mean the de-energising, severance and reconnection of and underground electrical supply cable, as well as disconnection and reconnection of water services. Care would need to be taken not to sever the fibre optic or phone lines in this area. It should be noted that there is a cost to Council in the disconnection and reconnection of underground services.

Therefore the only other option would be to locate the root barrier as shown by the red line in Photo 2, as underground services severely limit its placement outside of this location. It is noted that there is a large 300mm trunk water main that runs through this location as well which will be a major impediment to locating the Root Barrier here. Trenching for the installation of a root barrier in this area also has the added concern of being in close proximity to the power pole shown in Photo 2, this will need further assessment as to the future stability of the pole should trenching be carried out in such close proximity

This placement of the root barrier and associated severance of the root system in close proximity to the trunk will have severe impacts on health and the structural stability of the trees, and would be in contradiction to the Australian Standard AS 4373:2009 Protection of trees on development sites in regards to encroachment into the Tree Protection Zones (TPZ) and the tree's Structural Root Zone (SRZ).

In 2008 Ballina Shire Council installed a root barrier adjacent to the fig trees located in Bentinck Street Ballina near the 'One Stop' shop. This retrospective root barrier was placed as a result of court litigation from damage to Unit 1 16 Bentinck Street, as a result of root damage. This damage was extensive and resulted in the award of damages in excess of $30,000.00.
The trees were in a sound and healthy condition at the time of the root barrier installation, and have rapidly regressed since then to be in what is now considered a poor state of health, with the canopies on the 3 trees now in serious decline.

Photo 3: Decline in canopy of Fig trees (Bentinck street - One Stop Shop) with root barrier installed 2008

The above photo shows the tree in the foreground with considerably sparse canopy as compared to the trees in the back right hand side of the picture which did not have a root barrier installed. The canopy is now estimated to be 30% of total coverage as compared to almost 100% in 2008. This is a direct result of root severance from the installation of the root barrier installed in 2008.

The long term viability of these trees is currently not known but it is considered that as a result of the installation of the said root barrier, the trees now have a dramatically reduced lifespan.

The estimated total length of the required root barrier is 195 metres and would be installed by a commercial contractor. It is estimated that including the cost of disconnection of water service, and underground electricity the overall cost of installation of the root barrier would be in excess of $42,000.

The damage to the tree's root systems that the installation of a root barrier will cause will have a similar impact to these trees as occurred in Bentinck street. This in turn means that as the trees senesce as a result of the works there will be added costs of increased maintenance and the potential to have the cost of removal of these trees should the senesce to the point of being considered hazardous and or die, coupled with the cost involved in installing a root barrier means that significant monies will be spent with a high potential for a poor outcome and the potential to have to remove trees in the near future.

Option 2- Removal of Figs, Replacement Planting and Installation of Planting Blisters

The second option available is to remove the Fig trees that are causing problems with root encroachment.

The cost of removing these trees is estimated at between $28,000- $35,000 (based on a cost of app $4-$5000.00 per tree)

A redesign of the road reserve or nature strip could be carried out with the installation of 'planting blisters' and a more appropriate choice of replacement trees. While the loss of the Figs would have an immediate aesthetic impact on the streetscape the replacement of the trees would ultimately restore the streetscape and decrease the ongoing maintenance and liability costs that are associated with the current trees.

A root barrier would be installed when the new trees are planted to manage future root damage, this along with the planting of more appropriate tree species will ensure that the new trees do not pose a threat to the surrounding infrastructure, both overhead and underground.

The presence of overhead high voltage powerlines will influence the choice of replacement trees as the new trees would be smaller so as not to impact on the power lines.

With new clearance zones currently being implemented by essential energy (formerly Country Energy) and pruning guidelines for roads clearance, the replacement of these trees will be limited.

There are avenues to be considered in relation to replanting of these trees and future maintenance in regards to maintaining clearance zones. These include the potential to place electricity underground or use aerial bundled cable (ABC) to replace existing exposed live voltage lines.

It is understood that the removal of these trees will be an emotive community issue and will significantly change the aesthetics of the streetscape. Careful consideration has been given to all aspects of this situation and the recommendation that is being made.

7. Conclusion

In conclusion, the option of removal, replanting, redesigning and reconstruction of the parking areas along with the installation of appropriately designed planting blisters is the most suitable outcome for the elimination of the liability and associated costs of compensation due to property damage as a result of root encroachment from these trees.

While there would be a cost involved to council in the construction of these new planting blisters it is expected that this cost will offset the future maintenance costs and exposure to liability.

The installation of the root barrier is not expected to provide an effective root management option in this case. This is because of the nature of the Fig tree roots, the services that will affect the installation of the root barrier and the detrimental impact the installation of root barrier will likely have on the health of the trees, as well as the double cost of installation the removal of trees in the near future as a result of this poor health and decline

Removal is considered to be the most cost effective option in this situation as there is a high likelihood that the work will result in the death of the trees in the short term.

As a result of the impending costs and the predicted reduced life span of the trees as a result of poor health due to significant root loss, the option of placing the root barrier in close proximity to the trunk does not provide a viable or practical solution in this instance.

8. Recommendation

It is the recommendation of this report that Option 2 removal, redesign and replanting is the only option in regards to remediation of the issues with tree roots in this location.

9. References

1. Australian Standard – Pruning of Amenity Trees: AS 4373—2007, Standards Australia 2007

2. Australian Standard – Protection of trees on development sites: AS 4970—2009, Standards Australia 2009

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BALLINA SHIRE COUNCIL

SEPARATE ATTACHMENT (ATTACHMENT 5)

TO ITEM 11.2

FIG TREE MANAGEMENT

Ordinary meeting 25/1/12

Ballina Shire Council

PEER REVIEW
Tamar Street *Ficus* spp
Root Encroachment Report

2010

Project Team:
Gary Coleman
Robert Stavrou

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Appendices No.4 Ballina Shire Council – Water Assets Plan

1. SYNOPSIS

Ballina Shire Council (BSC) has engaged CHOICE - Landscape and Horticultural Consultants and Contractors (CHOICE LHCC) to peer review one of their internal arborist reports i.e. *Tamar Street Ficus spp Root Encroachment Report* prepared by Glen Hargrave - Supervisor Horticultural Works BSC.

This Peer Review document consists of;

- The Consultants Scope of Works.
- Methods utilized for assessment purposes to gather information i.e. the State and Local Government Planning Instruments researched.
- Subject Site and Subject Tree details.
- Visual annotations relating to the Subject Site and Subject Trees.
- Assumptions and Limiting Conditions to the details provided in body of this report.
- References utilized during the investigative and examination process.

2. CONSULTANTS SCOPE OF WORKS

The following Scope of Works (refer Appendices No. 1) involves;

1. Site Inspection – Site Inspections with BSC Arborist.
2. Peer Review of Council Report (dated 20/10/2009).
3. A peer reviewed written report - including alternative opinions to the report. Council will require a detailed explanation of the reasons and alternative recommendations as part of the peer review report.

3. BACKGROUND

3.1 General

A site inspection was carried out on the 5th May 2010, 21st June 2010 and 24th September 2010, between Glen Hargrave, (Ballina Shire Council), and CHOICE–LHCC to undertake a Subject Site and Subject Tree inspection.

3.2 Subject Site

The Subject Site is Tamar Street Ballina, the site lies in the Ballina Shire Council (BSC), Local Government region.

Removal of vegetation in this zoning is implemented through the Ballina Local Environment Plan, 1987 (BLEP).

3.3 History

As per the Consultants Scope of Works research is generally limited to Internet, interview and/or consultation with Ballina Shire Council staff.

Review of documents include but are not necessarily limited to:

- Ballina Shire Council (2009) - *Tamar Street Ficus spp Root Encroachment Report.*
- Ballina Shire Council (2009), *Water Assets – Rous Water Tamar Street.*
- Country Energy (2009), *Services Location Tamar Street.*
- Telstra (2009) *Mains Cable Plan Tamar Street.*
- Materials and Manufacturers of Root Barriers, Rubber Sidewalks, and Structured Soils.

4. FINDINGS

4.1 Site - Review

Present condition and shape of the Subject Trees indicate previous 'lopping' practices carried out to reduce tree height, maintain electrical easement and reduce 'nuisance' value to shoppers' and adjacent residents i.e. ease of parking, infrastructure access and visibility to properties.

Localised, the Subject Trees lay within various growing environments including grassy nature strips/road reserves, root development determined by sealed and paved road shoulders, adjacent concrete pedestrian pathways and associated above and below ground services.

Root damage has occurred to numerous exposed roots either from current parking practices, mowing regimes or from amended pedestrian pathway infrastructure.

The following Subject Site and/or Subject Tree observations are noted:

a) stress

A factor in a plants environment that can have adverse impacts on its life processes e.g. altered soil conditions (compaction, poor nutrition and reduced oxygen levels), root damage, toxicity, drought or water logging. The impact of stress may be reversible given good arboricultural practices e.g. mulching

b) poor pruning techniques not per *AS 4373-2007 Pruning of Amenity Trees.*

This standard indicates, what is considered to be the minimum acceptable industry requirements for pruning activities on trees, so as to minimise wounding and possible decay entry points. Pruning activities contrary to these standards utilizes essential tree energy and may subject a tree to adverse strain and stresses.

Previous 'lopping' practices have resulted in multiple epicormic growth at various stages in the Subject Trees development. This epicormic canopy growth has a potential for limb failure due to heavy apical growth. Additionally epicormic limb failure will result as stems compete for dominance in the tree canopy structure.

c) lower canopy reduction as per 9.2 Crown lifting of *AS 4373-2007 Pruning of Amenity Trees.* Refer Appendices No.4.

Crown lifting should be considered judiciously, as excessive crown lifting may cause disproportionate upper canopy end weight and may predispose a tree

to failure in adverse environmental conditions i.e. soil saturation point (maximum water level) in conjunction with high winds.

d) asymmetrical canopy

A disproportionate canopy is generally not an issue, as trees grow in relation to impacts within their surroundings. Caution is generally warranted in a high usage area due to storm damage; excessive lower canopy reduction works (crown lifting) and/or if damage occurs due to construction and/or maintenance activities over critical root zones or significant decay ingress occurs to primary scaffolding and/or anchorage roots.

All seven Subject Trees have been decay ingress and have been extensively lopped and topped under past and/or present pruning regimes.

e) anchorage roots reduced

Previous 'root pruning' practices have damaged anchorage roots. Extents of 'root pruning' practices for infrastructure developments were not detailed at the time of formulating this report.

f) mechanical damage

Visual observations indicated major root damage due to vehicular parking practices activities. This is known to cause entry points for decay organisms into the primary root structure of trees. Decay is generally observed at the base of tree roots damaged in this way.

g) crown dieback

Dieback starting at the top of the crown may be the first visual indicator of advanced root decay development on the Subject Trees and indicate future structural stability changes. Immediate inspection and/or remediation may need to be programmed.

h) tree protection

Adequacy of current and future tree protection techniques may need to be evaluated (of primary importance on trees of heritage/significance) as significant mechanical root damage to the Subject Trees was noted.

i) mulching

No adequate amounts of organic matter were observed on any of the Subject Trees. Organic material beneath tree canopies over the 'critical root zone' (CRZ) of trees stimulates micro-organism activity, assisting nutrient uptake and reduce soil compaction and mowing regime issues, improving long-term tree vitality, health and vigour.

4.2 Option No.1 - Root Barrier Installation - Review

Root Control Barriers (RCB) and Root Control Deflectors (RCD) are relatively modern technological advances, which have increased our management options for the retention and/or restriction of tree root mass.

Ideally or where success appears to be at its best, is when placement has been conceived in the initial tree planning process; or after tree inspections have been carried out, in the establishment period of a trees' lifespan.

Successful implementation of an RCB is generally determined by an impervious barrier to tree root invasion being created. The design of such systems often stipulates such guidelines - even perceived minor breaches appear to lead to long-term failure of the system.

To install such root barrier control systems in areas where significant services infrastructure already exists, is cause for concern; as the success of root restriction and/or retention is generally in relative proportion to the number and/ or frequency of breaches to the system.

It is outside the scope of this brief to specify, comment on and/or estimate the cost of service disconnections or reconnections.

Services indentified above and below ground included but were not limited to:

Fibre Optics, High and Low Voltage lines (HV and LV) telecommunications, water, stormwater and or /drainage and electrical service lines.

RCB placement in the environment above will require implementation of a back-up management cycle that has the ability for the system to be effectively inspected and/or to monitor the records of installation i.e. locations of where the system was breached then" *when and how it was patched*?".

It is considered that RCB and RCD installations more appropriately deflect and/or redirect roots as opposed to being a complete barrier.

With the above considerations being taken into account, I concur with the BSC Arborist that his recommended placement of RCB on the northern side of the pedestrian footpath; that it will reduce service infrastructure disruptions, reduce installation costs and in all probability be a quantum reduction in the likelihood of breaches of the RCB post installation.

It is outside the scope of this brief to comment on and/or suggest RCB suppliers, products, costs and/or installation practices for the Subject Trees.

Arboricultural 'best practice' indicates that supplier and/or product specifications are strongly recommended and to be followed and i.e. design installation and maintenance.

Tree root restriction and/ or retention on large and mature trees, generally has a multitude of secondary associated tree health issues that can develop after significant damage to primary, secondary and feeder root systems. If health issues are already evident in the target tree population (refer 4.1 Site Review), then RCB installation can be quite severe on future tree vigour and vitality.

Caution is generally warranted if significant damage has been done to remaining root systems as decay ingress can lead to partial and/or whole of tree, failures. N.B. tree root systems require evaluation as to importance for water and nutrient uptake and/or structural integrity prior to reduction, severance and/or damage to the root mass of individual trees.

Potential for decay entry by vertical trenching i.e. due to inappropriate root pruning practices (tearing and splitting), should be minimized.

Trees grow in relationship to their environment and hence the importance of the below ground (root structure) and above ground (tree habit/form) on the stability of a tree. Tree structural integrity above ground is dependant of the maintenance of the below ground stabilizing root mass.

The asymmetrical form of the Subject Trees (due to service clearance zones being maintained) requires significant above ground electrical HV and LV works to be implemented (conversion to Aerial Bundled Conductors), prior to any RCB installation; if tree structural stability is not to be compromised.

Generally, old trees and trees in poor health do not respond well to root pruning. Remedial strategies include curving sidewalks or pop-outs or relocation and/or eliminating sidewalks altogether.

Long-term mature tree maintenance programmes require formulation prior to RCB installation, taking in to consideration the timing of potential tree care strategies;

Maintenance options may include the following –

- service clearance zone reduction (considered to be of paramount importance),
- identification of primary scaffolding root mass i.e. utilization of arboricultural technology, such as Ground Penetrating Radar (GPR),
- planting blister construction and mulching (to reduce future mechanical damage and to increase future feeder root development),
- crown reduction strategies (to compensate for corresponding root plate loss),
- carbohydrate supplementation (to reduce the short-term impact of potential tree strain),
- cytokinin stimulation (to enliven the soil microorganisms to assist in water and nutrient uptake) and
- supplementary watering during periods of prolonged drought.

It is outside the scope of this brief to suggest, evaluate and/or propose short-term (prior to RCB installation) and/or long-term (post RCB installation) Tamar Street *Ficus* spp management programmes.

4.3 Option No.2 - Removal and Reformation of Planting Blisters – Review

Studies on rooting characteristics of species have been highly limited in number and scope. As a result, species lists providing assessments of rooting characteristics are based largely on field observations.

Matching tree species with planting space is a key strategy in reducing damage potential i.e. adequate planting space should be provided at the time of planting.

Selection of inappropriate species often leads to infrastructure conflicts. If large trees are required large spaces must be provided.

Root architecture varies form species to species, planting spaces must be large enough to accommodate species with strong trunk flare or root buttress.

5. CONCLUSIONS

5.1 Site

Tree management practices, those appear to be associated with current tree health issues; need to be evaluated.

A long-term mature tree care programme that takes into account the requirements and timing of potential tree health care and/or tree repair strategies; these tree health, care and repair options may include but are not limited to the following.

- ABC installation (with a reduction in the electricity clearance zone) is considered to be of paramount importance service in mature tree care,
- identification of primary scaffolding root mass i.e. utilization of arboricultural technology, such as Ground Penetrating Radar (GPR),
- design and utilization of pervious surfaces in future infrastructure works in close proximity to trees (processes that assist in long-term tree health care),
- planting blister construction and mulching (to reduce future mechanical damage and to increase feeder and structural root development),
- crown reduction strategies (for remediation or to compensate for corresponding root plate loss),
- carbohydrate supplementation where required (to reduce the short-term impact of current and future tree strain),

- rhizosphere stimulation and maintenance (to enliven soil microorganisms that are essential in tree water and nutrient uptake) and/or re-mulching,
- supplementary watering during periods of prolonged drought and
- appropriately qualified and experienced personnel in all facets of tree health and repair.

The above are considered essential requirements for both *Option 1- Installation of Root Barrier* and/or *Option 2 – Removal and Reformation of Planting Blisters* Installation.

N.B. Such programmes are primarily 'Tree', 'Infrastructure' or 'Rootzone' based strategies and/or a combination of any three of the aforementioned strategies.

A data collection process such as *'Evaluation of Strategies Worksheet'* (Beaudoin 2001 and Mann 2001) may assist in formulation *'for costs, longevity and feasibility'. 'Users can assess individual strategies based on local conditions and constraints'* (Costello and Jones 2003).

It is also considered that either *Option 1* or *Option 2* will result in the loss of car parking spaces.

5.2 Option No.1 - Root Barrier Installation

There are no precise recommendations specifying the percentage of root mass that can be cut, probably because every situation is unique and requires careful analysis.

The reviewed report appears to be primarily from a *'Infrastructure'* and then *'Rootzone'* based strategies background, as apposed to a *'Tree'* based strategy; this occurs regularly within Authorities' that have increased population pressures and then litigation concerns where mature trees are involved.

CHOICE - LHCC concurs with the BSC Arborist that the recommended placement of RCB on the northern side of the pedestrian footpath; in that it will reduce service infrastructure disruptions, reduces installation costs and in all probability result in a reduction of the likelihood of tree root breaches post RCB installation.

Any RCB installation in close proximity to a tree trunk (with significant root mass loss) will generally do damage to mature trees, as current tree health assessment was not part of this brief; it is unclear whether all of the Subject Trees will survive the severe environmental impacts post RCB installation i.e. loss of health, vigour, vitality and the associated structural stability concerns.

The uprooting safety of trees based on loads, trunk inclination and reduced root mass requires careful consideration.

Assessments of loss of structural strength in the individual Subject Trees are not given in this report.

A determination by BSC after review of their *'evaluating strategies worksheet'* may indicate that the Subject Trees may be expensive to retain i.e. severe health or structural defects requiring excessive levels of short and long term maintenance etc.

RCB or partial RCB Installation on specific trees based on the review of the report at hand cannot be totally discredited.

If remediation of the Subject Trees is a recommendation of the tree care programme; it is more than likely that *Option 1* pre RCB installation will lead to greater car park spacing losses than *Option 2* removal and reformation.

5.3 Option No.2 - Removal and Reformation of Planting Blisters

CHOICE – LHCC does not have the information at hand to determine whether the estimated costs of removal and reformation would be the more economical option. Discussions revealed that design and construction estimates were not available for the BSC Arborist for entry to the original report or for CHOICE – LHCC for peer review purposes.

Design and implementation of planting blisters should include strategies to minimize potential future damage to infrastructure; strategies can be either preventive or remedial.

Strategies for reducing infrastructure damage potential are generally organised into three groups, based on the focus of action.

1) Tree - Based Strategy

Species selection and root pruning are the two strategies that focus action on the tree. Selecting species that minimize damage potential is a critical preventative strategy, while removing roots that cause damage is a common remedial practice.

Information researched and collated should include but not be limited to:

- Tree species selection (for both the above and below ground ecosystems), stock quality, planting techniques, tree protection and maintenance requirements will require formulation as part of any design process.

- The ability if required to, with relative minimal outlay in human and fiscal resources; to restrict tree root mass i.e. root pruning.

2) Infrastructure - Based Strategy

These approaches can be met in design by creating planting spaces that large enough to reduce proximity of trees and infrastructure. They can also be met by using materials that increase the tolerance of concrete to cracking and lifting or by replacing concrete with alternative materials.

Initial design concepts should include but not be limited to whether:

- Slabs should be thicker and/or reinforced.
- Use of expansion joints and/or spacings.
- Use of asphalt.
- Utilization of pervious surfaces, decomposed granite, pavers, recycled rubber etc

3) Rootzone - Based Strategy

Rootzone - based strategies attempt to direct roots away from infrastructure (root guidance) or create conditions that encourage greater root distribution and deeper roots (soil displacement, soil modification or management and water management).

Initial design should include the following researched options but not be limited to any one individual strategy:

- Use of RCB's or RCD's.
- Installation of continuous trenches.
- Site specific soil modification requirements.
- Planning for root pathways.
- Structural Soil specifications.
- Use of steel plates.
- Efficient water usage and management.

CHOICE - LHCC concurs with the BSC Arborist that *Option 2* will in all likelihood be the most successful in eliminating current tree root conflicts with existing infrastructure.

6. ASSUMPTIONS and LIMITATIONS

1 Any legal description provided to the consultant/appraiser is assumed to be correct. Any titles and ownership to any property are assumed to be good and marketable. No responsibility is assumed for matters legal in character. Any and all property is appraised or evaluated as though free and clear, under responsible ownership and competent management.

2 It is assumed that any property is not in violation of any applicable codes, ordinances, statures, or other government regulations.

3 Care has been taken to obtain all information from reliable sources. All data has been verified in so far as possible; however, the consultant/appraiser can neither guarantee nor be responsible for the accuracy of information provided by others.

4 The consultant/appraiser shall not be required to give testimony or to attend court by reason of this report unless subsequent contractual arrangements are made, including payment of an additional fee for such services as described in the fee schedule and contract of engagement.

5 Loss or alteration of any part of this report invalidates the entire report.

6 Possession of this report or a copy thereof does not imply right of publication or use for any purpose by any other than the person to whom it is addressed, without the expressed written or verbal consent of the consultant/appraiser.

7 Neither all nor any part of the contents of this report, nor copy thereof, shall be conveyed by anyone, including the client, to the public through advertising, public relations, news, sales or other media, without the prior expressed written or verbal consent of the consultant/appraiser – particularly as to value conclusions, identity of the consultant/appraiser, or any reference to any professional society or institute or to any initialled designation conferred upon the consultant/appraiser as stated in his qualification.

8 This report and any values expressed herein represent the opinion of the consultant/appraiser, and the consultant/appraiser's fee is in no way contingent upon the reporting of a specified value, a stipulated result, the occurrence of a subsequent event, nor upon any finding to be reported.

9 Sketches, diagrams, graphs, and photographs in this report, being intended as visuals aids, are not necessarily to scale and should not be construed as engineering or architectural reports or surveys.

Unless expressed otherwise:

a) Information contained in this report conveys only those items that were examined and reflects the condition of those items at the time of inspection.

b) The inspection is limited to visual examination of accessible items without dissection, excavation, probing, or coring. There is no warranty or guarantee, expressed or implied, that problems or deficiencies of the plants or property in question may not arise in the future.

7. BIBLIOGRAPHY

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8. ABOUT the AUTHORS

Gary Coleman is a substantive teacher of horticulture and landscape at Wollongbar Campus of TAFE and has been involved in the horticulture industry for over 30 years. He has extensive experience with tree surveys and audits and local government in landscape design/specifications, construction, contract documentation and project coordination.

Qualifications

Advanced Horticulture Certificate
Certificate IV in Workplace Assessment & Training
Associate Diploma Horticulture – Park Management
Associate Diploma of Horticulture – Landscape
Diploma of Horticulture
Bachelor of Education

Robert Stavrou is a substantive teacher of horticulture and arboriculture at Wollongbar Campus of TAFE, and has been involved in the horticulture industry for over 28 years. He has considerable experience in landscape construction; arboriculture project coordination and tree survey work e.g. creation of a database incorporating 2600 plus, individual Street Tree Surveys for Bellingen Council as part of their *Street Tree Master Plan;* and the creation of their Street Tree database plus *The Tree Asset Management System* database for Ballina Shire Council.

Qualifications

Advanced Certificate in Urban Horticulture
Tractor Operation and Safety (Instructor)
Certificate IV in Workplace Assessment & Training (Trainer)
Chainsaw Operations Levels 1, 2 and 3 (Instructor)
Certificate III & IV (AQF) Horticulture - Arboriculture
Diploma of Teaching (Technical)
Diploma in Horticulture (AQF) - Arboriculture

Both authors are the Principals of CHOICE Landscape and Horticultural Consultants and Contractors.

APPENDICES

Appendices No. 1 Scope of Works

From: Glenn Hargrave [mailto:glennh@ballina.nsw.gov.au]
Sent: Tuesday, April 20, 2010 5:02 PM
To: gary774@bigpond.net.au
Subject: Scope Of Works Peer review Tamar St Figs

Gary
Please provide me with a quote for a peer review of Council Arborist report completed by myself in regards to the management outcomes of the Fig trees in Tamar St
Please see attached scope of works for quotation purpose. This is a pressing matter for council and the review, should your quote be accepted will need to carried out within 10 working days of receipt of purchase order for services. Please indicate if this will possible on you reply email. Quotation can be either in electronic format and should contain Business letter head and be authorised by appropriate company representative or can be posted to the following:

Attention: Glenn Hargrave C/O Ballina Shire Council

PO Box 450
Ballina NSW 2478

Should you require further information please do not hesitate to contact me on Ph: 66861460 or Mob: 0428 603 664

Regards

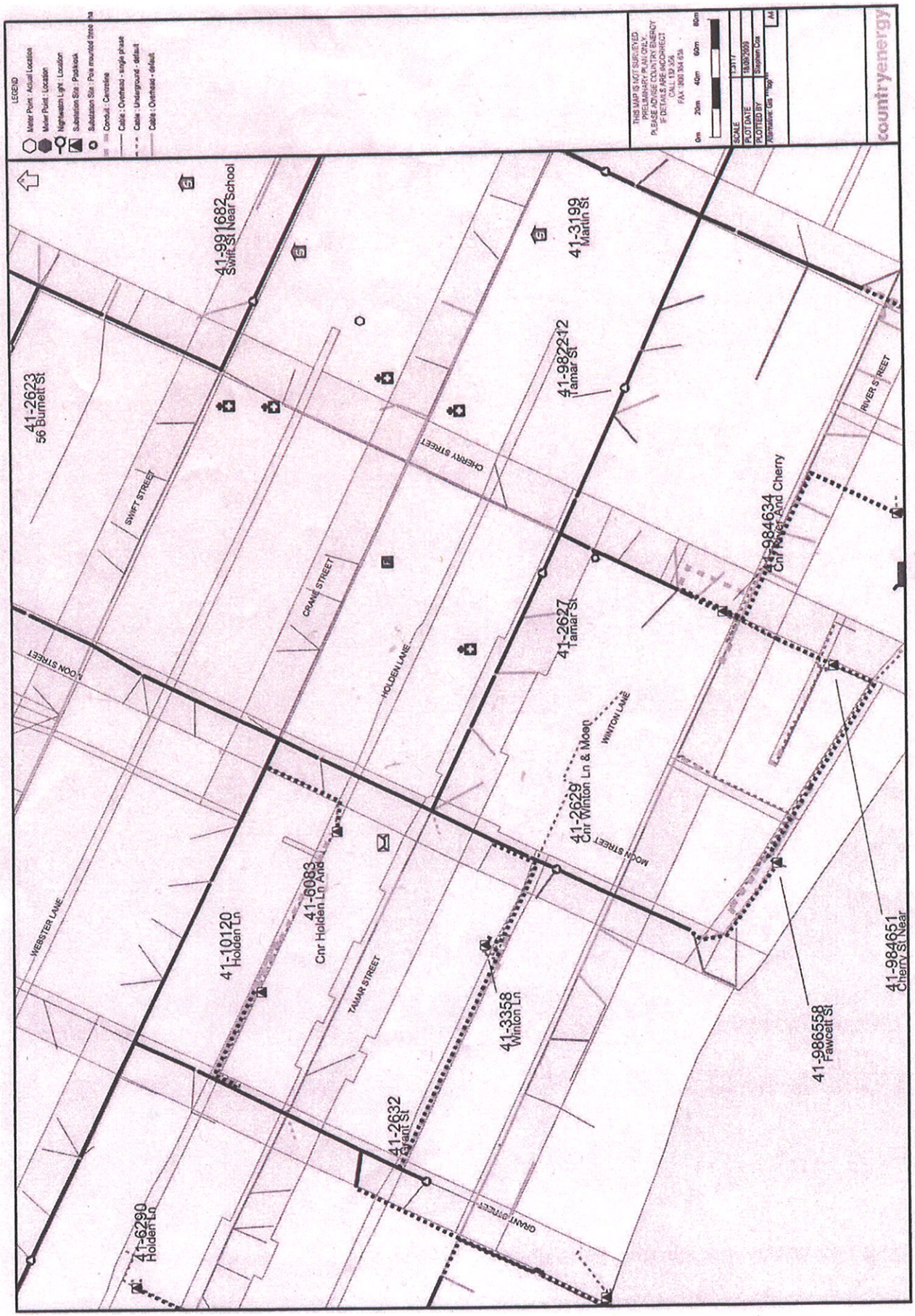
Glenn Hargrave | Supervisor Arboricultural Maintenance

Civil Services Group

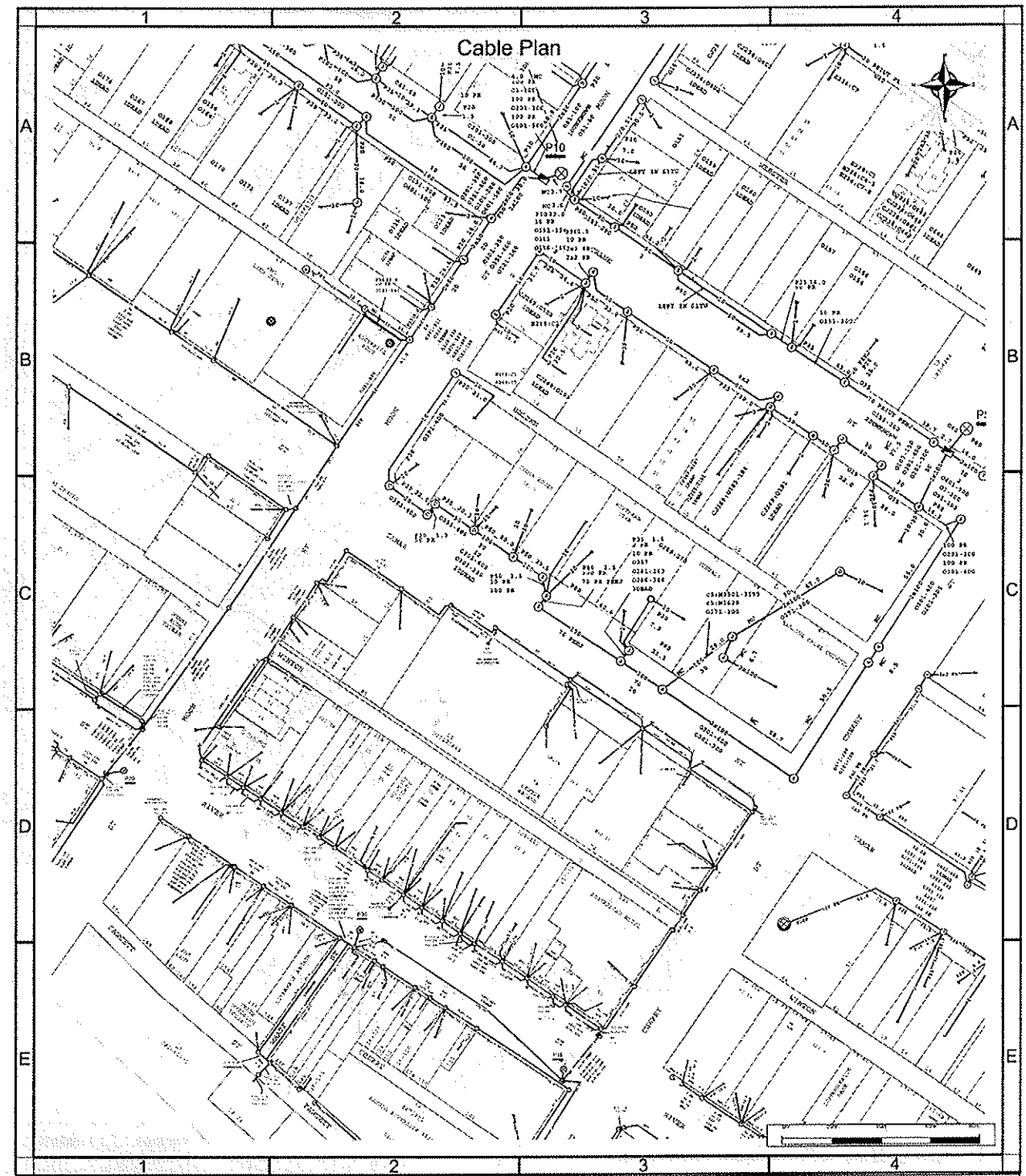
Ballina Shire Council

www.ballina.nsw.gov.au

Appendices No.2 County Energy - Services Location Plan



Appendices No.3 Telstra - Mains Cable Plans



Telstra For all Telstra DBYD plan enquiries - email - Telstra.Plans@team.telstra.com For urgent onsite contact only - ph 1800 653 935 (bus hrs)	Sequence Number: 16704628
	Exchange Area: BLNA
TELSTRA CORPORATION LIMITED A.C.N. 051 775 556	CAUTION: Fibre Optic cable is present in the requested plot area
Generated On 14/09/2009 08:15:26	

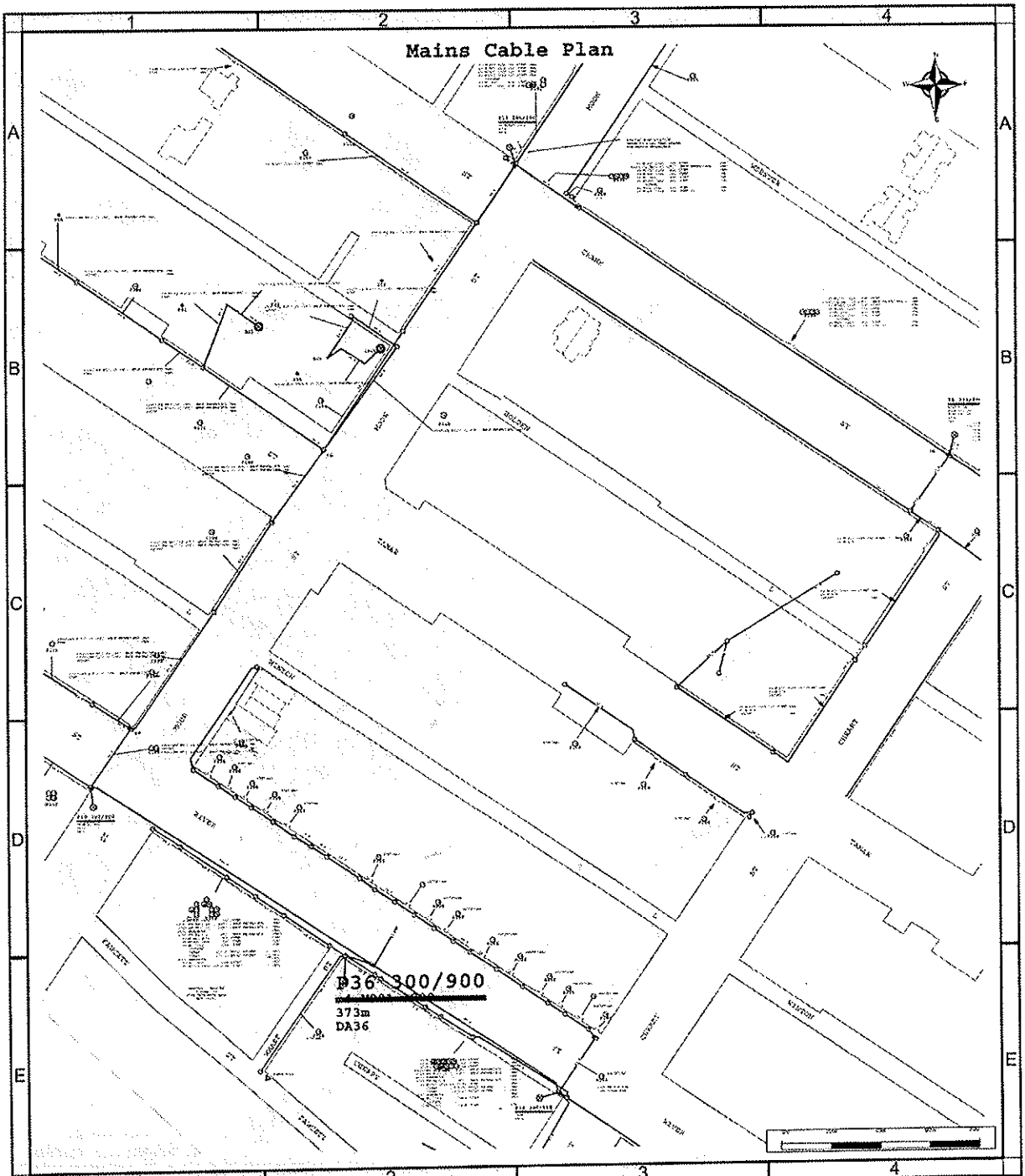
The above plan must be viewed in conjunction with the Mains Cable Plan on the following page

WARNING - Due to the nature of Telstra underground plant and the age of some cables and records, it is impossible to ascertain the precise location of all Telstra plant from Telstra's plans. The accuracy and/or completeness of the information supplied can not be guaranteed as property boundaries, depths and other natural landscape features may change over time, and accordingly the plans are indicative only. Telstra does not warrant or hold out that its plans are accurate and accepts no responsibility for any inaccuracy shown on the plans.

It is your responsibility to locate Telstra's underground plant by careful hand pot-holing prior to any excavation in the vicinity and to exercise due care during that excavation.

Please read and understand the information supplied in the duty of care statement attached with the Telstra plans. TELSTRA WILL SEEK COMPENSATION FOR LOSS CAUSED BY DAMAGE TO ITS PLANT.

Telstra plans and information supplied are valid for 60 days from the date of issue. If this timeframe has elapsed, please reapply for plans.



Telstra For all Telstra DBYD plan enquiries - email - Telstra.Plans@team.telstra.com For urgent onsite contact only - ph 1800 653 935 (bus hrs)	Sequence Number: 16704628
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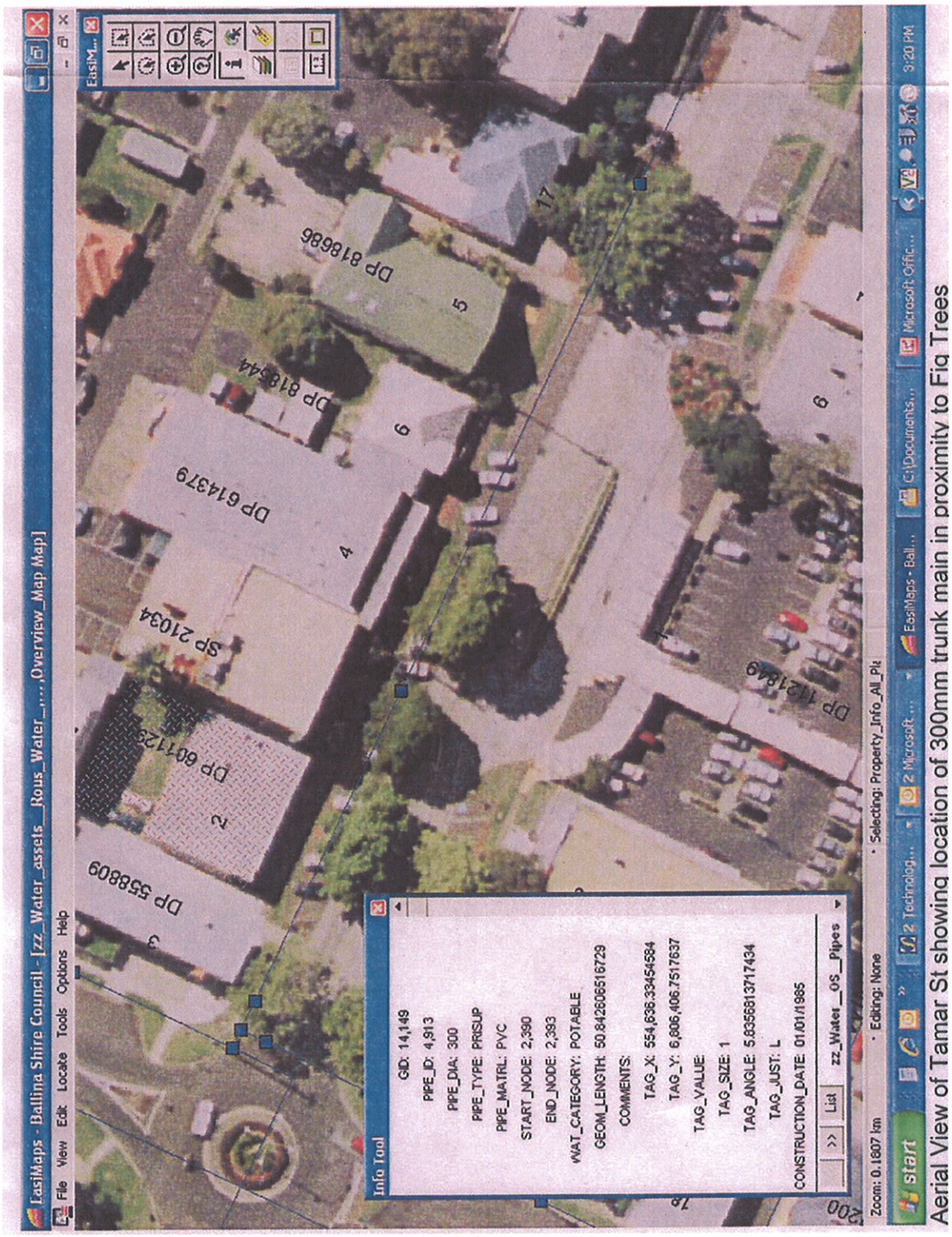
Appendices No.4 Ballina Shire Council – Water Assets Plan



Aerial View of Tamar St showing location of 300mm trunk main in proximity to Fig Trees

BALLINA SHIRE COUNCIL

SEPARATE ATTACHMENT (ATTACHMENT 6)

TO ITEM 11.2

FIG TREE MANAGEMENT

Ordinary meeting 25/1/12

ROBERT STAVROU AND ASSOCIATES

Consultants Scope of Works

Monday, 23 May 2011 3:45 PM
Robert

Thank you for the notification of the cessation of CHOICE. As the principal consultant on the previous peer review report Council is happy to accept you as Robert Stavrou of Robert Stavrou and Associates to finalise this report for Council in lieu of CHOICE now being no longer operational.

I look forward to getting this one finalised ASAP and to continuing to work with you as a Consultant for Council in your new venture as Robert Stavrou and Associates.

Regards

Glenn Hargrave | Supervisor Arboricultural Maintenance
Civil Services Group
Ballina Shire Council
www.ballina.nsw.gov.au

'Peer Review
Tamar Street Ficus spp Root Encroachment Report 2010'

Tamar Street *Ficus* spp Peer Review - General

Tree removals are generally an unpopular but eventually essential part of managing any population of trees in the urban forest. All living organisms generally have a genetically programmed life-span; environmental influences during this life-span determine species retention and indeed longevity.

Over-mature, senescing trees, trees in isolation, trees damaged indiscriminately, trees planted in the wrong locations etc may become an issue; requiring more maintenance and/or removal over time to mitigate perceptions of risk.

Responsibility for tree replacement and tree management failure in our urban forests is currently being researched. Dr James Hitchmough has identified some of reasoning behind these potential failures;

- *there seems to be a desire to believe that trees, if not immortal; are at least very long-lived...*
- *In Australia there is limited experience with the useful life of amenity trees; in many established areas we still have the original urban plantings. Apart from the relative short period of European settlement of Australia the fact that some urban areas are still going through redevelopments blurs the picture on the longevity of tree species...*

- *the public veneration of trees, particularly large specimens has both positive and negative impacts. On the plus side, asset managers need to operate in a professional manner. On the minus side it can be difficult to achieve anything because of public perceptions ...*

- *fear by management authorities of adverse public responses to tree removal and/or tree replacement programmes. This public reaction is not always based on relevant facts...*

- *tree replacement strategies require a commitment to planning as well as community education and/or involvement. A major limitation for many authorities is that budgets are linked to the financial year. The lack in many instances of skilled staff in tree management also compounds this problem...*

- *the fear of significant costs associated with serious tree replacement programmes. It may cost thousands to remove and/or replace existing trees. In the short-term fiscal management process, there is nothing cheaper than doing nothing; so understandably this is an attractive option for some statutory managers. ..*

  (anecdotal evidence Judy Fakes)

If the do-nothing approach is taken, there are problems in the long-term. As trees decline and become more hazardous, there is a risk of liability if these trees cause damage to people and/or property. As individual trees die and are either being replaced or not replaced the character of the landscape changes and becomes less cohesive as well as more difficult to manage on a systematic basis.

Tamar Street *Ficus* spp Peer Review - Synopsis

As had been stated by CHOICE - LHCC in their *Peer Review* we also concur ***'all seven Subject Trees have decay ingress and have been extensively lopped and topped under past and/or present pruning regimes.'***

The health and condition of the Subject Trees was assessed per the guidelines by Matheny and Clarke (1994). The health of the Subject Trees was assessed by observing vigour as exhibited by tree crown density, leaf colour, presence of epicormic shoots, the degree of dieback and ability to withstand increasing exposure to adverse environmental conditions.

There can be no guarantee that *'Crown Maintenance'* and/or *'Modification'* works and specific Tree Removal works will mitigate the future likelihood of risk to people and/or property from the Subject Trees.

As had been stated by CHOICE - LHCC in their *Peer Review* we also concur; ***'it is outside the scope of this brief to suggest, evaluate and/or propose short-term (prior to RCB installation) and/or long-term (post RCB installation) Tamar Street Ficus spp management programmes.'***

As had been stated by CHOICE - LHCC in their *Peer Review* we also concur; ***'with the BSC Arborist that his recommended placement of RCB on the northern side of the pedestrian footpath; that it will reduce service infrastructure disruptions, reduce installation costs and in all probability be a quantum reduction in the likelihood of breaches of the RCB post installation.'***

As had been stated by CHOICE - LHCC in their *Peer Review* we also concur; ***'to install such root barrier control systems in areas where significant services infrastructure already exists, is cause for concern; as the success of root restriction and/or retention is generally in relative proportion to the number and/ or frequency of breaches to the system.***

Proposed infrastructure development requires appropriate tree protection planning and construction detailing to Australian Standards and Industry Best Management Practice procedures.

There can be no guarantee Tree Protection Works during infrastructure development will mitigate the future likelihood of risk to people and/or property from the Subject Trees.

Tamar Street *Ficus* spp Peer Review - Conclusion

As had been stated by CHOICE - LHCC in their *Peer Review* we also concur; ***'with the BSC Arborist that Option 2 will in all likelihood be the most successful in eliminating current tree root conflicts with existing infrastructure.'***

'Option 2- Removal and reformation of planting blisters

The option of removal is considered to be the only 100% sure method to control root encroachment. Removal is considered to be a cheaper option then installing a root barrier in regards to the subject trees and their location, however at the time of this report no costing or design for Tamar St have been compiled in regards to re planting and reconstruction of planting blisters.

N.B. there can be no guarantee that any of the above works if tree retention is specified and/or carried out correctly (to Australian Standards and Industry Best Management Practice procedures) can or will mitigate the likelihood of risk in this current environment.

Robert Stavrou **Consulting Arborist**