

### Walking the Landscape

#### Overview

- Total area of Wet Tropics region is 22,229.6 km<sup>2</sup>. Tully catchment is 1 683.5 km<sup>2</sup> in area, amounting to 7.6% of the region
- This is a high rainfall area. The mean annual rainfall is 3316 mm, but this varies between 2000 and 4000 mm across the catchment (Wallace et al., 2009). Annual average River Flow 3448,088ML. Rainfall is strongly seasonal, with 80% occurring during the wet season from December to May.
- The time between rainfall and runoff is short in the Tully as large storms can occur over the whole basin and the distance from headwaters to the coast is short (Furnas, 2003).
- Dominant geology consists of old highly weathered granites and limited amounts of basalt at elevation metamorphics fractured rocks, alluvium of varying sands and silts. Unconsolidated muds, mudrocks and coastal sand deposits.
- A million years of sediment has uplifted and created the coastal ranges. Either side is granite and has two phases of granite intrusion. Granites are generally resistant to weathering, so the higher elevations in this basin (e.g. around 800m above sea level around Koombooloomba Dam, Mount Tyson and Mount Mackay) are granite formations and form a plateau. A small amount of Atherton basalt is found along the valleys and infilled valleys. The Rhyolite was created either side of the two different phases of granite intrusion in the Tully and the Ingham Tablelands. Metamorphics give rise to the finer materials – clays.
- Coarse sand (2000 – 250µm) = 0.4µm, Fine sand (62 – 250µm) = 4µm, Silt (4 – 62µm), Clay (0.24 – 4 µm) Turner et al. (2013).
- The upper end of the catchment is steep and in a large area of vegetated National Park. Wet Tropics bioregion of north-eastern Queensland catchments are characterised by steep mountain and escarpment streams that abruptly lose gradient as they cross short floodplains.
- The catchment is well vegetated in the upper and limited in the lower (Jarra Creek most vegetated creek).
- Most of the geological formations take a NW-SE angle. The Tully fault line is the most influential element of the catchment. The fault line has resulted in the Tully Gorge. The river runs straight through the fault zone. The river takes the line of least resistance along the fault line. The river runs in straight lines and then changes e.g. dog legs created from the fault lines underpinning the system. The water course runs around the granite intrusions, around and through the valley through where the intrusions have come up.
- The highest elevation point in the basin is at the headwaters of Cochable Creek, which flows through basalts and other volcanic geologies from an elevation of around 1100m above sea level.
- The floodplain is composed of materials derived from the granites and metamorphic parent material. The sandy material comes from the granites and the more clayey material comes from the Atherton basalt and the metamorphics. At the mouth, volcanic basalts run through the valleys.
- Nearly all wetlands have peat in them (down to 4 metres). It is rare to have peat in wetlands in Queensland. These are large carbon sinks. Fire has a role in the regeneration of the wetlands in this catchment, but because of the peat fire needs to be managed carefully. If it is burnt at the wrong time of year and there is not enough water, it will end up with peat fires that can't be put out.
- Davidson Creek has isolated wetlands and a continuation of wetlands underneath the surface that hold wetlands up behind granite intrusions.
- The alluvium is found in the floodplain, granite and sandy material and metamorphic from top end give rise to the finer grain. The basalts are the older part of the sequence. The younger basalts are porous and have a lot of aquifers; they break down to red soils. The older basalts the fines get caught and don't have a lot of high yielding aquifers. The older basalts have been around longer and so are more weathered like clays they don't take up water. The alluvium in this area is rich and this is the reason for a high amount of agricultural activities such as cane and banana's. All these geological processes have given rise to it.
- One of the biggest wetland complex's in terms of area are found in the wet tropics, there are a lot of wetland formation in the bottom of the system due to the flat nature of the landscape. Wetland development occurs in the alluvial areas downstream of Davidson Creek and in the coastal zone between Mission Beach and Yingalinda Beach.
- There are coastal processes that have occurred coming down from Innisfail all the way along the coastal range from Hull River. There are also big alluvial areas from the large amount of sand deposited by mouth of flood plain. There is also a lot of sand that has been deposited because of the coastal processes and lack of ranges.
- This is a very wet catchment and there is not much infiltration in granites they have a high, fast run off and creates a flashy system. The alluvium down the end acts as a damper and seeps into the creeks over time and slowly gets out. It gets around four meters of rain throughout the whole catchment. It is critical to take this into account when looking at the interventions. It is faster at the top of the system and infiltrates into the alluvium aquifer which will keep the system going during the drier periods and there used to be a huge amount of Ground Dependant Ecosystems (GDE's). Generally there is no infiltration at the top near the Tully gorge and is very localised in-filtration in the springs where there are a few fractures. Granites sometimes generate hot water (radioactive).
- Koombaloomba Dam: sits on a plateau of granites and provides flows which support hydroelectric power generation. The plateau creates a regular discharge of water from the dam which affects the base flow of water from the system. But it is such a fast run off catchment that it maintains a fair flow from the other streams running into the system.
- It is pulsed in the mornings around 8am – 9am for the Tully white water rafting.
- The Dam bypasses a major section in the main channel. Areas 299/294/287 water bypasses this section and there is no water inflow than other than Nitchaga Creek as it is cut off due to the dam.

## Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)

---

- Groundwater – surface to groundwater interaction not at top but there is an interaction within alluvial areas. Different clay layers will hold the water in the alluvium where as more sand in the alluvium allows for more transitivity.
- There is an extensive series of drainage channels throughout the lower end to drain water out of the landscape.
- There is a hydrological connection between the Tully and Murray basins in the subsurface portions of the alluvium.
- Water from the Tully and the Murray often merges during a flood, forming one large inundated area, often termed the Tully–Murray floodplain.
- The area continues to have grazing as well as irrigated cropping (including tree fruits and sugarcane). Land use in basin consists predominantly of natural / minimal use lands, sugarcane, bananas, grazing, forestry, urban and other land uses.
- Agricultural activity is primarily in alluvial / colluvial zones of the Tully River basin.
- Jarra Creek is an important lowland area that has not been developed.
- Residential development is limited to the flatter coastal areas of (e.g. Tully, Midgenoo, Mission Beach, Wongaling Beach, South Mission Beach, Hull Heads, Rockingham, Googarra Beach and Tully Heads).
- One of the highest priority areas for reducing pollutant loads to the GBR in the Wet Tropics.
- The Tully Basin generates moderate proportions of anthropogenic pollutant loads to the total Wet Tropics regional load and is ranked fourth for most pollutants, except for DIN where it is second to the Johnstone basin (and produces 19% of the regional anthropogenic load). Approximately 16% of the regional PSII herbicide load is from the Tully Basin.
- Sugarcane in this basin contributes 88% of the anthropogenic DIN load exported from the basin. Sugarcane contributes >99% of the PSII herbicide loads from the basin.
- The Lower section of Travelling Dairy Creek has been identified as a hotspot for suspended solids, while sub-catchments the Southwest of Tully of the basin are hotspots for DIN and PSII herbicide loads.
- Weeds present in basin – varying densities / distributions.
- Hymenachne and para grass are well established in lagoons, in which their long stolons develop into a dense mat extending over the water surface some distance from the bank (Arthington et al., 1997; Bunn et al., 1997, 1998).
- Coastal alluvial zones support groundwater dependent vegetation.
- Beach ridges are located between Wongaling Beach and South Mission Beach, north of the mouth of the Hull River, and south of the mouth of the Tully River towards the northern limits of Yingalinda Beach.
- There are two estuarine areas at Tully River and Hull River.
- Flooding can occur up to 10 times during a wet season but on average there are three to four overbank floods per year (Wallace et al., 2009).
- Most wetlands connect to either the Tully River or the Murray River via creeks and cane drains. Frequent floods (ARI = 1 year) inundate more than one-third of the floodplain and more than half of it is inundated by larger floods (ARI = 20 years).
- The wetlands are the remnants of a large number of similar habitats that existed in the bioregion before agricultural development, which has led to as much as 80% of wetlands being drained and filled in some catchments (e.g. the Herbert: EPA, 1999; Johnson et al., 1999).
- Flows in the stream and drainage network decline during the dry season, when some of the wetlands become disconnected from the main river channels (Karim et al., 2012).
- National Parks: Tully Falls, Tully Gorge , Koombooloomba, Girramay, Hull River, Mount Mackay, Djiru, Clump Mountain, and the offshore Family Islands.
- Forest Reserves: Koombooloomba South.
- Conservation Parks: Jalum and Djilgarin.

**Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)**

**OVERVIEW of entire Tully WTL 2015**

Tully River – perennial

Reach	Slopes		Natural terrain		Natural hydrological		Modifications		Sediment and water quality issues	Sufficient riverine vegetation	Other
	High rainfall area	Land zone surrounding (alluvial) channels	Geology and significant natural features	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure				
	HR–state layer	LZ–state layer	G–state layer	attendees	SW–state layer	LU–state layer	W&D–state layer	attendees	attendees	attendees	
<b>Entire</b>	Steep, rapid fall to flatter alluvium.	- Between 1999mm and 4801mm p.a. over entire basin	<ul style="list-style-type: none"> <li>1 – Tidal flats and beaches</li> <li>2 – Coastal dunes</li> <li>3 – Alluvium</li> <li>8 – Basalt plains and hills</li> <li>11 – Hills and lowlands on metamorphic rocks</li> <li>- 12 – Hills and lowlands on granitic rocks</li> </ul>	<ul style="list-style-type: none"> <li>- Tully River runs along fault line.</li> <li>- Predominantly granites in higher areas transitioning to alluvium with small areas of metamorphics and mudstone.</li> <li>- Small areas of basalt.</li> <li>- Hull River, intact, braided systems.</li> <li>- Tully and Hull Rivers come out very close together, some connectivity during flood (perhaps shared historically).</li> </ul>	Well incised, widening and infilling in areas.	- Perennial because of rainfall and groundwater in the lower parts of the catchment.	<p>The Tully Basin has an area of 1,685 km<sup>2</sup> and has a high proportion of natural/minimal use lands (75%). The remaining area is comprised of 12% sugarcane, 4% bananas, 5% grazing, 2% forestry, 1% other crops, 1% urban and 3% other land uses.</p> <p>- Inside of the range (western side – Feluga area) rural residential development and other side of highway.</p>	- Flows during dry season are highly regulated.	<ul style="list-style-type: none"> <li>- The latest Source Catchments modelling suggests that TSS, DIN, PN, DIP and PP loads have increased by 2.4 fold, 2.0 fold, 2.0 fold, 1.7 fold and 2.5 fold, respectively since European settlement (c. 1860) using the 'Base' load scenario (Table 15; Hateley et al., 2014).</li> <li>- The Tully basin generates moderate proportions of anthropogenic pollutant loads to the total Wet Tropics regional load and is ranked fourth for most pollutants, except for DIN where it is second to the Johnstone basin (and produces 19% of the regional anthropogenic load). Approximately 16% of the regional PSII herbicide load is from the Tully Basin.</li> <li>- The Source Catchments analysis suggests that 45% of the total DIN load is sourced to sugarcane land use while bananas contribute 13% of the total DIN load from the Tully Basin. The model suggests that sugarcane in this basin contributes 88% of the anthropogenic DIN load exported from the basin. Sugarcane contributes &gt;99% of the PSII herbicide loads from the basin</li> <li>- Potential Hotspots: The Lower section of Travelling Dairy Creek has been identified as a hotspot for suspended solids,</li> </ul>	<ul style="list-style-type: none"> <li>- Limited riparian vegetation remaining.</li> <li>- Palm swamps into top of Hull River.</li> <li>- Mid Tully - rainforest.</li> <li>- Preclear – <i>Melaleuca viridiflora</i>, found all around mid-lower Murray.</li> <li>- Lower Tully-Murray (where parallel) - <i>Melaleuca quinquenervia</i> and pockets of eucalypt (mahogany glider)</li> <li>- Lower Tully some significant remnants - mostly east of hwy on Tully and west of hwy on Murray.</li> <li>- Imperata grasslands.</li> </ul>	<ul style="list-style-type: none"> <li>- Frequent fires</li> <li>- Logging and past land use practices has impacted vegetation – regrowth</li> </ul>



## Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)

boundary – dunal system  
constrains water to some  
extent.  
- Mouth of Tully - sand  
deposits - probably good  
aquifers - possibly prone  
to saltwater intrusion if  
extraction was taking  
place.  
-



- Largest remaining area of natural floodplain left and not developed in the Wet Tropics.
- Large sub catchment
- Along another fault line

**Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)**



TULLY UPPER										
Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall and hydrological features	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
<b>Tully Upper</b> O'Leary Creek (326) Costigan Creek (323) Culpa Creek (318) Sylvania Creek (310) Ellen Creek (310) Phyllis Creek (310) Goddard Creek (313) Dingo Creek (306) Koombaloo Creek (306) McLachlan Creek (306) Saturday Creek (306) Friday Creek (306) Thursday Creek (306) Niblet Creek (296) Carpenter Creek (299) Carron Creek (299)	<b>Slopes</b> Steep slopes  <b>Land zone</b> – 12 (Hills and lowlands on Granite rocks)	- minimal alluvium - granite - small bit of mafites and felsite's in Niblet Creek	High rainfall - Creeks have water holes - In the wet season = high flow  - Can go dry and into a series of pools. Springs in areas	- ill – defined - bed rock controlled - Fast runoff - Confined  -Natural weir below holding up water into a pool at the confluence of the river and the creek.	- Little SW-GW interaction	- Managed resource protection	- No dams, weirs and infrastructure		- Similar vegetation to surrounding vegetation - Little riparian vegetation	- Frequent fires  - Logging and past land use practices has impacted vegetation – regrowth



**Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)**

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall and hydrological features	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
326 O'Leary Creek (see Tully Upper)	<p><b>Slopes</b> Up to 878m at the headwaters of O'Leary Creek. Other peaks include 800m and 848m.</p> <p><b>Land Zones</b> Mostly</p> <ul style="list-style-type: none"> <li>- 12 (Hills and lowlands on Granite rocks)</li> </ul> <p>Some</p> <ul style="list-style-type: none"> <li>- 8 (Basalt plains and hills)</li> </ul> 	<p>Large area of:</p> <ul style="list-style-type: none"> <li>- Granite</li> </ul>	2000 - 2401mm/yr			- Nature conservation =100%				
323 Costigan Creek (see Tully Upper)	<p><b>Slopes</b> Up to 845m at the headwaters of Costigan Creek and another peak at 810m.</p> <p><b>Land Zones</b></p> <ul style="list-style-type: none"> <li>- 12 (Hills and lowlands on Granite rocks)</li> </ul> 	<p>Large area of:</p> <ul style="list-style-type: none"> <li>- Granite</li> </ul>	2000 - 2801mm/yr			- Nature conservation = 100%				



**Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)**

Reach name, polygon number	Natural terrain		Natural hydrological		Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall and hydrological features	Channel (width, depth, slips)	SW-GW, recharge areas	Land use			
318 <i>Culpa Creek</i> Several unnamed creeks (see Tully Upper)	<p><b>Slopes</b> Up to 900m at the headwaters of Culpa Creek several peaks include 877m 815m and 813m.</p> <p><b>Land Zones</b></p> <ul style="list-style-type: none"> <li>- 12 (Hills and lowlands on Granite rocks)</li> </ul> 	Large area of: <ul style="list-style-type: none"> <li>- Granite</li> </ul>	2399 - 2401mm/yr			- Nature conservation = 99.76%			
310 <i>Sylvania Creek</i> <i>Ellen Creek</i> <i>Phyllis Creek</i> (see Tully Upper)	<p><b>Slopes</b> Up to 865m at headwaters of Phyllis Creek.</p> <p><b>Land Zones</b></p> <ul style="list-style-type: none"> <li>- 12 (Hills and lowlands on Granite rocks)</li> </ul> 	Large area of: <ul style="list-style-type: none"> <li>- Granite</li> </ul>	2399 - 2401mm/yr			- Nature conservation = 99.60%			

**Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)**

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall and hydrological features	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
313 <i>Goddard Creek</i>  <i>Several unnamed creeks</i>  <i>(see Tully Upper)</i>	<p><b>Slopes</b> Up to 820m 814m close to dam</p> <p><b>Land Zones</b></p> <ul style="list-style-type: none"> <li>- 12 (Hills and lowlands on Granite rocks)</li> </ul> 	<p>Large area of:</p> <ul style="list-style-type: none"> <li>- Granite</li> </ul> <p>Area of mixed Mafites and Metamorphics (felsites) (mostly volcanics)</p>	2000 - 2401mm/yr			<ul style="list-style-type: none"> <li>- Nature conservation =99.40%</li> </ul>				
306  <i>(see Tully Upper)</i>  <i>Dingo Creek</i>  <i>Koombooloomba Creek</i>  <i>McLachlan Creek</i>  <i>Saturday Creek</i>  <i>Friday Creek</i>  <i>Thursday Creek</i>	<p><b>Slopes</b> Up to 948m at the headwaters of Koombooloomba Creek. 853m at the top of Koombooloomba Pocket and 794m at the dam.</p> <p><b>Land Zones</b></p> <ul style="list-style-type: none"> <li>- 12 (Hills and lowlands on Granite rocks)</li> </ul> 	<p>Large area of:</p> <ul style="list-style-type: none"> <li>- Granite</li> </ul>	2000 - 2401mm/yr			<ul style="list-style-type: none"> <li>- Nature conservation= 99.41%</li> </ul>				

**Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)**

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall and hydrological features	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
296 <i>(see Tully Upper)</i> <i>Niblet Creek</i>	<p><b>Slopes</b> Up to 900m at Cardwell Range. 829m peak at headwaters of Niblet Creek.</p> <p><b>Land Zones</b></p> <ul style="list-style-type: none"> <li>- 12 (Hills and lowlands on Granite rocks)</li> </ul> 	<p>Large area of:</p> <ul style="list-style-type: none"> <li>- Granite</li> </ul> <p>Area of mixed Mafites and Metamorphics (felsites) (mostly volcanics)</p>	2000 - 2801mm/yr			<ul style="list-style-type: none"> <li>- Nature conservation = 98.59%</li> </ul>				
299 <i>(see Tully Upper)</i> <i>Carpenter Creek</i> <i>Carron Creek</i>	<p><b>Slopes</b> Up to 820m at the headwaters of Tuesday Creek.</p> <p><b>Land Zones</b></p> <ul style="list-style-type: none"> <li>- 12 (Hills and lowlands on Granite rocks)</li> </ul> 	<p>Large area of:</p> <ul style="list-style-type: none"> <li>- Granite</li> </ul>	1600 - 2401m m/yr			<ul style="list-style-type: none"> <li>- Mostly nature conservation = 95.54%</li> <li>- other minimal use around the dam = 2.95%</li> <li>- reservoir/dam = 1.41%</li> </ul>	Main Dam			


## Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)

### Dam Overview

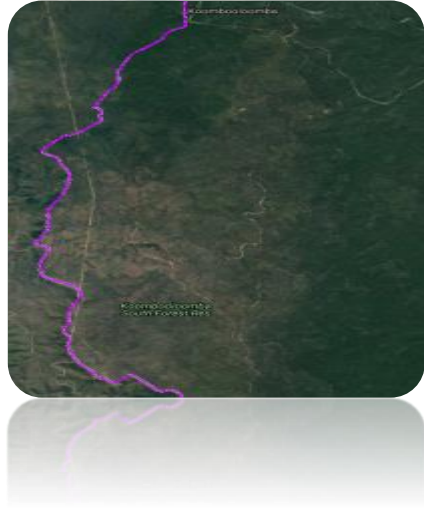
The water from the dam flows down the River to the Tully falls where it is piped thereby bypassing 294 and 287 on the main channel. It is pulsed in the mornings around 8am – 9am for the Tully white water rafting.

The Dam gets water from these sub catchments: 326, 318, 323, 310, 300, 306, 299, 296, 313, 317, 309, 311, 306,304, 297, 303 (*Please refer to Nitichga Creek and Cochable Creek*).

Hydro power is the primary purpose of the dam.

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall and hydrological features	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
<b>Dam:</b>  <b>Land Zones</b> - 12 (Hills and lowlands on Granite rocks) - <b>Dam:</b> 	<ul style="list-style-type: none"> <li>- Water bodies</li> <li>- Dam underlain by granites</li> <li>- reservoir/dam – Koombooloomba (built in 1956)</li> <li>- Dam built for hydro power</li> <li>- The Dam on the western side is drier (2.5m of water). The eastern side is steeper.</li> <li>- 35 m deep dam (approx.), sections up to 65 m deep where old river channel is and when the dam is at 40%</li> </ul>	2000 – 2401mm/yr  - Lacustrine waterbody	Lack of connectivity  - 4.5km of river length has no water flowing due to the water flowing through the pipes.	minimal	<ul style="list-style-type: none"> <li>- Reservoir/dam</li> <li>- Tully falls has a weir</li> </ul>	<ul style="list-style-type: none"> <li>- Storage of the dam depends more on demand of power rather than rainfall.</li> <li>- One hydro station at dam wall, second one down at Tully falls weir.</li> <li>- Gaging in dry flow – 11ML a day.</li> </ul>	- Water in the dam is clear – minimal turbidity	<ul style="list-style-type: none"> <li>- Fish have been translocated into the dam for fishing purposes. Barramundi, sooty grunter. Due to the size of the Tully falls.</li> <li>- Lack of aquatic connectivity.</li> <li>- A lot of endemic species above the dam and aquatic species in the freshwater</li> <li>- Highly fluctuating dam levels. Can be down at 10-15% and then up to 110% within the same year.</li> </ul>		

**Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)**

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall and hydrological features	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
300 Nitchaga Creek George Creek Robinson Creek Wall Creek Carron Creek Limestone Creek Taylor Creek Upper Tully	<p><b>Slopes</b> Up to 880 at the headwaters of Taylor Creek. Several peaks include 802m, 807m and 790m)</p> <p><b>Land Zones</b> Mostly</p> <ul style="list-style-type: none"> <li>- 12 (Hills and lowlands on Granite rocks)</li> </ul> <p><b>Some</b></p> <ul style="list-style-type: none"> <li>- 3 (Alluvium)</li> <li>- 8 (Basalt plains and hills)</li> </ul> 	Large area of: <ul style="list-style-type: none"> <li>- Granites on the east</li> <li>- The river runs down the fault with granite on the east and metamorphics on west and river runs down between them.</li> <li>- Small amount of basalt on western side.</li> </ul>	1500 - 2401mm/yr  Reliable flow – does go back to series of pools never stopped – semi permanent).	<p><u>Top</u></p> <ul style="list-style-type: none"> <li>- Distinct channel – well defined and sandy.</li> <li>- Bed rock control, sandy bottom.</li> <li>- ill-defined channels in granite upper.</li> </ul>	<ul style="list-style-type: none"> <li>- Good surface water to ground water interaction.</li> <li>- Not a big aquifer – pieces of aquifers with springs.</li> </ul>	<ul style="list-style-type: none"> <li>- Nature conservation =36.18%</li> <li>- Managed resource protection = 63.40%</li> <li>- Mostly disturbed by logging.</li> <li>- Historically disturbed</li> </ul>			<ul style="list-style-type: none"> <li>- Vegetation eucalypt.</li> <li>- Small patch of melaleuca wetlands on the western side with clay and wetter.</li> <li>- Riparian – (variable) little bit patchy and sparse not whole length of stream.</li> </ul>	<ul style="list-style-type: none"> <li>- Drier</li> <li>- Stats – annual flow mean 29,000 ML</li> <li>- Important system in terms of refugia.</li> </ul>
294 Silkwood Creek Campbell Creek Winton Creek Upper Tully	<p><b>Slopes</b> Up to 809m 720m at main channel of Tully River and 760 at Dam.</p> <p><b>Land Zones</b> Mostly</p> <ul style="list-style-type: none"> <li>- 12 (Hills and lowlands on Granite rocks)</li> </ul> <p><b>Some</b></p> <ul style="list-style-type: none"> <li>- 8 (Basalt plains and hills)</li> </ul>	Large area of: <ul style="list-style-type: none"> <li>- Granite</li> <li>- Metamorphics (felsites) (lavas, clastics and high level intrusives).</li> </ul>	1600 - 2401mm/yr			<ul style="list-style-type: none"> <li>- Nature conservation =98.44%</li> </ul>	<ul style="list-style-type: none"> <li>- No flow as by-passed.</li> </ul>			<ul style="list-style-type: none"> <li>- Tully falls</li> </ul>



**Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)**

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall and hydrological features	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
 293 Python Creek Spring Creek Upper Tully	<p><b>Slopes</b> Up to 826m at headwaters of Python Creek</p> <p><b>Land Zones</b> Mostly</p> <ul style="list-style-type: none"> <li>- 12 (Hills and lowlands on Granite rocks)</li> </ul> <p>Some</p> <ul style="list-style-type: none"> <li>- 8 (Basalt plains and hills)</li> </ul> 	<p>Large area of:</p> <ul style="list-style-type: none"> <li>- Metamorphics (felsites) (lavas, clastics and high level intrusives).</li> </ul> <p>A small area of Basalt</p>	1600 - 2801mm/yr			<ul style="list-style-type: none"> <li>- Nature conservation =95.80%</li> <li>- Other minimal use = 3.86%</li> </ul>				
287 Cheetah Creek Spring Creek Upper Tully	<p><b>Slopes</b> Up to 840m at the headwaters of Cheetah Creek. Several other peaks. Approx. 479 peak at the main channel of Tully River.</p> <p><b>Land Zones</b> Mostly</p> <ul style="list-style-type: none"> <li>- 12 (Hills and lowlands on Granite rocks)</li> <li>- 8 (Basalt plains and hills)</li> </ul>	<p>Large area of:</p> <ul style="list-style-type: none"> <li>- Metamorphics (felsites) (lavas, clastics and high level intrusives).</li> <li>- Basalt</li> </ul> <p>Granites East and West</p> <p>Cheetah Creek- headwaters in basalts.</p>	1600 - 2401mm/yr	- Steep with a gorge		<ul style="list-style-type: none"> <li>- Nature conservation = 99.58%</li> </ul>	No flow as by-passed.		<ul style="list-style-type: none"> <li>- Tully Falls National Park</li> <li>- Tully gorge lookout</li> </ul>	


**Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)**

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall and hydrological features	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
257 Cannabullen Creek Read Creek Carter Creek Cochable Creek <i>(Upper north catchments)</i>	<p><b>Slopes</b> Up to 1175m several peaks in the area ranging from 305m to 941m.</p> <p>Steep gorge</p> <p>The highest elevation point</p> <p>Big flat plateau then deeply cut</p> <p><b>Land Zones</b></p> <ul style="list-style-type: none"> <li>- 8 (Basalt plains and hills)</li> <li>- 12 (Hills and lowlands on Granite rocks)</li> </ul> <p>Some</p> <ul style="list-style-type: none"> <li>- 3 (alluvium) main channel</li> </ul>	<p>Large area of:</p> <ul style="list-style-type: none"> <li>- Metamorphics (felsites) (lavas, clastics and high level intrusives).</li> <li>- Basalts (middle)</li> <li>- Metamorphics to the west,</li> <li>- Granites to the east</li> </ul>	2000 - 2801mm/yr	<ul style="list-style-type: none"> <li>- High rainfall area meaning fast runoff</li> <li>- Flowing north to south</li> <li>- Steep with a gorge</li> <li>- Permanent. Due to basalts slowly bleeding water in, high rainfall and large catchment area)</li> <li>- Same characteristics either side.</li> <li>- Ill -defined channels in headwaters.</li> <li>- Rocky</li> <li>- Near permanent waterholes.</li> <li>- More sand in system looks like upper part of Tully.</li> <li>- River has cut into the basalt that has flowed down the creek.</li> <li>- Paleo channels underneath the basalt – basalts right to river edge.</li> </ul>	<ul style="list-style-type: none"> <li>- Surface to groundwater recharge.</li> <li>- Fractured rock aquifers and basalts feeding in from the west.</li> </ul>	<ul style="list-style-type: none"> <li>- Grazing native vegetation = 4.13%</li> <li>- Nature conservation (National Park) = 95%</li> <li>- Rainforest throughout</li> <li>- Area is rainforest but has been selectively logged in the past except for Cannabullen Creek.</li> <li>- Very important vegetation – 1A.</li> <li>- Forestry tracks all the way through</li> <li>- Land use – development up at top – plateau area the rest is National Park.</li> <li>- Tully falls forest reserve</li> </ul>	<ul style="list-style-type: none"> <li>- No dams weirs or infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>- Naturally minimal riparian in the headwaters but good riparian in the main channel.</li> </ul>	<ul style="list-style-type: none"> <li>- Elizabeth Grant plateau and coachable plateau</li> <li>- Set aside parts of Elizabeth plateau to preserve because very rich in terms of bio value</li> <li>- Old growth through this area</li> <li>- Big falls in Cannabullen.</li> <li>- Bunya pines – naturally occurring (south east corner).</li> </ul> <p><u>Gauging station:</u></p> <ul style="list-style-type: none"> <li>- 167,137ML annual flow.</li> <li>- Oct 4,282 – 33,442 – metres.</li> <li>- Rainfall mean : Oct = 45 mm, March = 352 mm.</li> </ul>	


**Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)**

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall and hydrological features	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
267 Cochinbeerum Creek Koolmoon Creek <i>(Upper north catchments)</i>	<p><b>Slopes</b> Up to 1119m at Mount Koolmoon at headwaters of Koolmoon Creek.</p> <p><b>Land Zones</b></p> <ul style="list-style-type: none"> <li>• 8 (Basalt plains and hills)</li> <li>• 12 (Hills and lowlands on Granite rocks)</li> </ul> 	<p>Large area of:</p> <ul style="list-style-type: none"> <li>- Basalt</li> <li>- Mixed mafites and metamorphics (felsites) mostly volcanics</li> </ul> <p>Lot of basalt in this area</p>	<p>1600 – 3201mm/yr</p> <ul style="list-style-type: none"> <li>- Rainfall adds to system.</li> </ul>	<ul style="list-style-type: none"> <li>- Fast flowing</li> <li>- incised channel</li> <li>- Permeant and fast flowing with boulders.</li> <li>- Full of rock, boulders</li> <li>- No connection in the system due to the waterfall.</li> <li>- Waterfall natural barrier downstream – connection to system</li> </ul>	<p>Good SW-GW through fractured rock, rock aquifers and basalt.</p>	<ul style="list-style-type: none"> <li>- Nature conservation = 99.8%</li> <li>- Other minimal use = 0.11%</li> </ul> <p>(All National Park (Tully Falls National Park).</p>	<p>No infrastructure</p>		<ul style="list-style-type: none"> <li>- Little riparian due to little alluvium.</li> </ul>	<ul style="list-style-type: none"> <li>- Elizabeth Grant falls with exposed rock outcrop.</li> </ul>
<p><b>Main channel (upper Tully)</b></p> <p>From Nitchgia to Cochable</p> <p>300 , 299, 294, 293, 287, 257, 291</p> <p>See Dam overview</p>	<p>Not much natural catchment,</p> 	<p>Metamorphics all the way down. Through Basalts at Canabullen.</p>	<p>1501 – 2801mm/yr</p> <ul style="list-style-type: none"> <li>- Major channel runs through an area below falls.</li> <li>- No flows from here apart from small area of catchment around it 293/297 unsure where water is from.</li> </ul>	<ul style="list-style-type: none"> <li>- Water coming in from somewhere because even water present when dry.</li> </ul>	<p>Mostly:</p> <ul style="list-style-type: none"> <li>- Managed resource protection</li> <li>- Nature Conservation</li> </ul> <p>Some:</p> <ul style="list-style-type: none"> <li>- Production forestry</li> </ul>	<p>The Koombalooma Dam.</p>		<ul style="list-style-type: none"> <li>- Some recruitment of species growing in that stretch that would not normally be growing there because it is unnaturally dry (identified species adapted to drier condition).</li> <li>- no riparian</li> <li>- Altered vegetation.</li> </ul>	<ul style="list-style-type: none"> <li>- Not much water coming from other systems - most goes to coachable.</li> <li>- No water through gorge – ecological impacts.</li> <li>- Wet season there are decent flows in the stretch, but that is the only time. A little bit of flow during the dry times coming from somewhere.</li> </ul>	

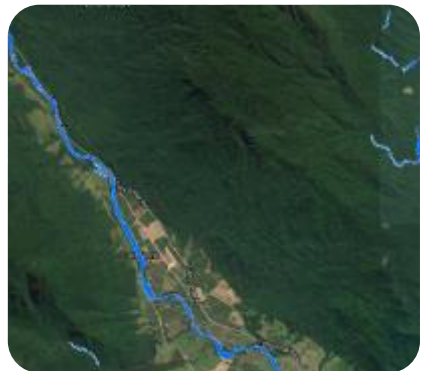
**Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)**

TULLY MID										
Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall and hydrological features	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
<p><i>Mid Tully</i></p> <p>291, 285,302, 295, 315, 320, 308</p> <p>Floodplain shallow. Deeper and wider further down underlain by metamorphics and granites.</p> <p>Upper – short and sharp.</p> <p>Laser levelling more recent development, last 10 years, changes hydrology.</p> <p>Main gorge area has granites to the east and metamorphics to the west.</p> <p>Picture below showing middle area of the Tully.</p> 	<ul style="list-style-type: none"> <li>- Granites to east metamorphics to the west</li> <li>- Development (shallow alluvium).</li> <li>- Alluvium off metamorphics probably have more clay than sand.</li> </ul>	<ul style="list-style-type: none"> <li>- High rainfall</li> <li>- Small wetland areas between cane and the river probably affected by surrounding area</li> </ul>	<ul style="list-style-type: none"> <li>- Channel – bedrock controlled.</li> <li>- short sharp systems</li> <li>- Flow – fast, permanent flowing – controlled. Pulsed 8-9am in the morning for rafting.</li> <li>- Tully River – below release of water into the system – down to Tully bridge</li> <li>- upper fast runoff fractured</li> <li>- not very incised rocky channels.</li> <li>- Palaeochannels along the river</li> <li>- Main channel – deep main channel, 3-4 m deep, gravel base</li> <li>- getting deeper incised banks, fairly stable</li> <li>- Natural levee on the river</li> <li>- Continuous fluctuation.</li> <li>- Well defined channels east of Davidson’s Road.</li> </ul>	<ul style="list-style-type: none"> <li>- Little bit of infiltration</li> <li>- Fractured rock under surface in the alluvium.</li> <li>- Minimal aquifers at the top.</li> <li>- Aquifers in the lower slopes.</li> </ul>	<p><u>Upper</u></p> <ul style="list-style-type: none"> <li>- National Park on north side and south side.</li> </ul> <p><u>Lower</u></p> <ul style="list-style-type: none"> <li>- Grazing on main channel – hydro stage 2.</li> <li>- West on western side, grazing</li> <li>- agriculture up to the bank</li> <li>- development of agriculture and bananas</li> </ul>	<ul style="list-style-type: none"> <li>- The Koombalooma dam is shut for maintenance – the river dries up the water holes which are important for refugia.</li> <li>- Draining the bananas means diverted away from recharging the river</li> <li>- Water extraction for bananas still underway.</li> </ul>	<ul style="list-style-type: none"> <li>- Minimal riparian then changes in the floodplain</li> <li>- Riparian – river cherries and river grass growing.</li> <li>- Good riparian starting (trapping alluvium) but still cascading – few little back waters.</li> <li>- Riparian minimal through cane area,</li> <li>- Hymenachne, Singapore daisy and paragrass</li> </ul>	<ul style="list-style-type: none"> <li>- All entering the Tully.</li> <li>- This stretch commercial white water rafting – pay for water to be released (value to area).</li> <li>- Main area camp ground.</li> <li>- Indigenous stories about how the rock held the water.</li> <li>- Major issues of the pulsing effects sooty grunthers – laying their eggs when the water is high (the eggs will be out of water). Despite the fluctuation there is movement of the fish up into the Coachable Creek.</li> <li>- This is because the fish move into natural side systems such as Cochable where the flow is natural</li> <li>- The sooty grunter is not plentiful in the river like they used to be.</li> <li>- The flow cue for spawning has also been effected.</li> <li>- Tully Gorge – gaging station – not a huge fluctuation – trying to mimic natural system but not as good</li> </ul>		


**Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)**

										as what it should be. - Pulsing – changes due to hydroelectric flow has changed. - Connections for species -
285 Several unnamed creeks (see 291-285)	<p><b>Slopes</b> Up to 800m. Several other peaks of 544m and 524m. Approximately 200m on the main channel.</p> <p><b>Land Zones</b> Mostly</p> <ul style="list-style-type: none"> <li>- 3 (alluvium) main channel</li> <li>- 12 (Hills and lowlands on Granite rocks)</li> </ul> <p>Some</p> <ul style="list-style-type: none"> <li>- 8 (Basalt plains and hills)</li> </ul> 	<p>Large area of:</p> <ul style="list-style-type: none"> <li>- Granite - upper slopes</li> </ul> <p>Small amount of:</p> <ul style="list-style-type: none"> <li>- alluvium and mixed mafites and felsite's (mostly volcanics)</li> <li>- lower end of the floodplain</li> </ul>	2000 – 4001mm/yr	<ul style="list-style-type: none"> <li>- Non-permanent</li> <li>- ill-defined channels</li> <li>- fast run off</li> <li>- bed rock controlled</li> <li>- confined</li> </ul>		<ul style="list-style-type: none"> <li>- Nature conservation = 99.84%</li> </ul>				



**Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)**

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall and hydrological features	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
295  Several unnamed creeks	<p>Up to 800m.</p> <p><b>Slopes</b></p> <p><u>Upper</u></p> <p>High slopes</p> <p><u>Lower</u></p> <p>Flat in the lower area</p> <p><b>Land Zones</b></p> <p>Mostly</p> <ul style="list-style-type: none"> <li>- 12 (Hills and lowlands on Granite rocks)</li> </ul> <p>Some</p> <ul style="list-style-type: none"> <li>- 3 (alluvium) main channel</li> </ul> 	<p>Upper</p> <p>Large area of:</p> <ul style="list-style-type: none"> <li>- Granite</li> <li>- Steep in upper parts – bowl like.</li> <li>- Rocks move into sand – transition zone.</li> </ul> <p><u>Lower floodplain</u></p> <ul style="list-style-type: none"> <li>- Alluvium developing</li> </ul> <p>Hydraulic head – effect of granites below surface and fractured rock aquifers which creates soggy areas. This is worse in the wet season – after the increase pressure from the rain.</p>	<p>2000 – 4001mm/yr</p>	<ul style="list-style-type: none"> <li>- Free flow all the way down – connected system from Cochable Creek to mouth of Tully</li> <li>- Perennial – due to releases.</li> </ul> <p><u>Cardstone</u></p> <ul style="list-style-type: none"> <li>- First place for drainage into natural creeks.</li> <li>- Fast run off into alluvial areas</li> <li>- Little creeks into Tully</li> <li>- Deeply incised not wide for channels going into the main channel.</li> </ul> <p><u>Lower</u></p> <ul style="list-style-type: none"> <li>- Channel well incised into the alluvium</li> <li>- Cobbles</li> <li>- Energy dropping</li> </ul>	<ul style="list-style-type: none"> <li>- Alluvium, good surface to ground water interaction.</li> <li>- There are springs at a point in time then they disappear.</li> </ul>	<p><u>Upper</u></p> <ul style="list-style-type: none"> <li>- Nature conservation = 77.16%</li> </ul> <p><u>Lower</u></p> <ul style="list-style-type: none"> <li>- Alluvium deposited = agricultural activities.</li> <li>- Irrigated perennial horticulture (bananas) = 10.96%</li> <li>- Native grazing vegetation = 6.15%</li> <li>- Other minimal use = 5.33%</li> <li>- Move from intensive to more grazing.</li> <li>- A little bit of grazing property south east foot hills coming down.</li> </ul>	<p><u>Lower Floodplain</u></p> <ul style="list-style-type: none"> <li>- Drained during wet season and irrigated during the dry for bananas.</li> <li>- Some will still irrigate during wet if for fertiliser (licensed allocations).</li> <li>- Licenses – were area based now volume based. For community this has major effect on the water flow.</li> </ul>		<p><u>Steep slopes</u></p> <ul style="list-style-type: none"> <li>- Condition of riparian – bramble and wait a while, siam weed.</li> </ul> <p><u>Lower floodplain</u></p> <ul style="list-style-type: none"> <li>- Riparian is minimal</li> <li>- 7310a – rainforest same veg type as Daintree.</li> <li>- Small swamps and melaleuca and pandama</li> <li>- Riparian on drainage lines</li> </ul>	<ul style="list-style-type: none"> <li>- Water as a cultural heritage resource.</li> <li>- <i>Water resource plan – 2013.</i></li> <li>- Careful for rehabilitation. In the past near the shed would have been an old paleo channel.</li> <li>- Endemic species in the poorly drained areas (lower in the floodplain).</li> <li>- WQIP – 10 years ago – water use – comments from community license at the time were not capped or checked unlimited use to river water – unsure if changed – major effect on the water flow of the river. Changing at the moment – converted to a volume and meter entitlement – this strict now a water. Daily volume that they can take 6.5ML per hectare</li> </ul>



**Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)**

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall and hydrological features	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
291 Several unnamed creeks	<p><b>Slopes</b> Up to 600m around 43m at the main channel.</p> <p><b>Land Zones</b> Mostly</p> <ul style="list-style-type: none"> <li>- 12 (Hills and lowlands on Granite rocks)</li> </ul> <p>Some</p> <ul style="list-style-type: none"> <li>- 3 (alluvium) main channel</li> </ul> 	<p>Large area of:</p> <ul style="list-style-type: none"> <li>- Metamorphics (felsites)</li> </ul> <p>Small amount of:</p> <ul style="list-style-type: none"> <li>- Basalt</li> <li>- Alluvium</li> </ul>	2000 - 2801mm/yr			<ul style="list-style-type: none"> <li>- Nature conservation = 78.7%</li> <li>- Other minimal use = 14.4%</li> <li>- Grazing native vegetation = 6.72%</li> <li>- Grazing on main channel.</li> </ul>			<p><u>Lower –</u></p> <ul style="list-style-type: none"> <li>- Hydro stage 2.</li> </ul>	


**Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)**

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall and hydrological features	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
<p><b>Main channel</b></p> <p><i>Mid Tully</i></p> <p>291, 295, 302, 320, 315, 308, 322, 319</p>	<p><b>Slopes</b></p> <p>Main Channel at around 15m above sea level</p> <p>More undulating further down</p> <ul style="list-style-type: none"> <li>- 3 (alluvium)</li> </ul> <p>Pictures below showing area of mid Tully main channel:</p>   <p>Picture below showing river changing direction.</p>	<ul style="list-style-type: none"> <li>- alluvium</li> </ul>	<ul style="list-style-type: none"> <li>- Sandy soils derived from granites – wet during wet season. The dry periods fluctuates widely.</li> </ul>	<ul style="list-style-type: none"> <li>- Channel – well incised into alluvium.</li> <li>- Channels less incised as move down into 315</li> <li>- River terraces</li> <li>- The river changes direction (an old route). The river moved (around 1940's - 1950's). See picture opposite</li> <li>- Deep main channel, 3-4 m deep, gravel base, getting deeper incised banks, fairly stable.</li> <li>- Connections from the Tully right up into the Barbed Wire Creek.</li> <li>- Sand in main channel (near Barbed Wire Creek)</li> <li>- Water holes – but fast flowing and cascading (near Kooroomool Creek)</li> <li>- Natural weirs used as a causeway – pebbly rock end of gibber field.</li> </ul>	<ul style="list-style-type: none"> <li>- Granite underneath the surface of alluvium and holds the water up. The drainage takes the water off. Can be seen closer to the granite hills.</li> <li>- Some fractured rock aquifers – coming to the surface. The pressure – pushes up to the surface quite fast which creates wet areas closer to surface of the hills.</li> <li>- Large area to north east fractured rock water coming down.</li> </ul>		<ul style="list-style-type: none"> <li>- Irrigation from the river (big pumps)</li> <li>- Large uptake computerised (Innisfail) fertilizer monitor constantly – within industry</li> <li>- Laser levelling more recent development, last 10 years, changes hydrology</li> <li>- Used to have more sand - now para grass - this has changed in water movement</li> <li>- Paragrass has taken over the sandbanks. This stops the migration of sand. The river now takes sand from the other side of the bank. So opposite the paragrass the bank is now eroding.</li> <li>- The paragrass cannot be sprayed as it will release fine sediments to the reef.</li> </ul>		<ul style="list-style-type: none"> <li>- On the bend – grassland (blady grass) used to be there.</li> <li>- On the Tully main channel riparian is minimal/no n-existent.</li> </ul>	<ul style="list-style-type: none"> <li>- Major issues of the pulsing effects sooty grunTERS – laying their eggs when the water is high, and then the eggs will be out of water. Despite the fluctuation there is movement of the fish up into the Coachable Creek. This is because fish move into natural side systems such as Cochable where flow is natural.</li> <li>- The sooty grunter is not plentiful in the river like they used to be. The flow cue for spawning has also been effected</li> </ul>


Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall and hydrological features	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
 302 Kooroomool Creek Stony Creek	<p><b>Slopes</b> Up to 925m (Mount Kooroomool) several other peaks (335m and 804m).</p> <p><b>Land Zones</b> Mostly - 12 (Hills and lowlands on Granite rocks) Some - 3 (alluvium) main channel</p> <p>More clay</p> 	<p>Large area of:</p> <ul style="list-style-type: none"> <li>- Metamorphics (felsites)</li> </ul> <p>Small areas of:</p> <ul style="list-style-type: none"> <li>- Granite</li> <li>- Alluvium</li> </ul> <p>Big boulders at top smaller at the bottom.</p> <p>Granite shoots at the bottom with waterfall.</p>	<p>2000 – 3201mm/yr</p> <p>Waterfall close to the edge</p>	<ul style="list-style-type: none"> <li>- Fast run off</li> <li>- Main channel – water holes – but fast flowing and cascading.</li> <li>- Permanent flow.</li> <li>- Paleo channels where the river jumped around over time.</li> <li>- Very small free board between dam and catchment at the top.</li> <li>- mobile system</li> </ul>	<ul style="list-style-type: none"> <li>- Fractured rock in the metamorphics – local recharge.</li> <li>- Floodplain in alluvium good surface to groundwater interaction.</li> <li>- Springs</li> </ul>	<ul style="list-style-type: none"> <li>- Nature conservation = 80.48%</li> <li>- Other minimal use = 16.83%</li> <li>- Grazing native vegetation = 4.56%</li> <li>- Irrigated perennial horticulture (Bananas). = 2.69%</li> </ul> <p>Banana's drain into wetland – treatment of bananas.</p> <p>Old channel movement of where they are not doing so well. Unstable fragile area.</p>	<ul style="list-style-type: none"> <li>- Small farm dam in centre</li> <li>- Falls act as a natural barrier to fish migration.</li> </ul>		<p><u>Upper</u> – minimal riparian</p> <p><u>Floodplain</u> Riparian present at ridgeline.</p> <p>Area unstable from a fluvial point of view.</p>	<p>Management action: Banana's run off into wetland.</p>


**Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)**

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall and hydrological features	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
315 Barbed Wire Creek	<p><b>Slopes</b> Up to 442m at headwaters of Barbed Wire Creek. Around 21m at the main channel.</p> <p><b>Land Zones</b></p> <ul style="list-style-type: none"> <li>- 3 (alluvium) main channel</li> <li>- 12 (Hills and lowlands on Granite rocks)</li> <li>-</li> </ul> <p>Alluvium off metamorphics probably have more clay than sand</p> 	<p>Large areas of:</p> <ul style="list-style-type: none"> <li>- Metamorphics (felsites)</li> <li>- Granite</li> <li>- Alluvium (shallow)</li> </ul> <p><u>Upper</u></p> <ul style="list-style-type: none"> <li>- Upper part similar to upper basin</li> <li>- All the same all the way down (metamorphics).</li> <li>- Same effect fractures rocks underneath the surface at the alluvium.</li> <li>- Fractured rocks</li> <li>- Very rocky with minimal sediment</li> </ul> <p><u>Floodplain</u></p> <ul style="list-style-type: none"> <li>- Undulating –</li> <li>- Geology alluvium – shallow, with little.</li> <li>- Geology: alluvium but shallow</li> <li>- Flatter on the right hand side.</li> <li>- Old paleo channels.</li> </ul>	<p>2000 – 2401mm/yr (High rainfall)</p>	<p><u>Upper</u></p> <ul style="list-style-type: none"> <li>- Shallow channels, rocky no sediments.</li> <li>- 1m or so deep channel</li> <li>- Fast run off</li> <li>- A little bit of infiltration</li> <li>- not very incised rocky channels</li> </ul> <p><u>Lower</u></p> <ul style="list-style-type: none"> <li>- Tully River itself is quite deep 3-4 m deep leaving the farm land much higher than the river and safe from flooding.</li> <li>- Lateral movement – pretty stable.</li> <li>- Rocky, gravel and deeper in the banks. More sand and blow out's along the river.</li> <li>- River does run dry – pools not a big catchment.</li> </ul>	<ul style="list-style-type: none"> <li>- Fractured rock will be under surface in the alluvium.</li> <li>- little bit of infiltration</li> <li>- Melaleuca woodlands – water is perched. Poorly draining soils. Clay there will hold the water up a bit more.</li> </ul>	<p><u>Upper</u></p> <ul style="list-style-type: none"> <li>- Nature conservation (at headwaters) =55.90%</li> </ul> <p><u>Lower</u></p> <ul style="list-style-type: none"> <li>- Grazing native vegetation = 18.81% (west of north Davidson Road)</li> <li>- Irrigated perennial horticulture (Bananas)= 10.48%</li> <li>- Other minimal use =10.30%</li> <li>- Cropping – Sugar = 3.40%</li> <li>- Irrigated land in transition 1%</li> <li>- Too wet to grow anything intensive on western side – grazing in this area.</li> <li>- Cane and bananas at the bottom of sub catchment.</li> <li>- Agriculture up to bank of river.</li> </ul>	<ul style="list-style-type: none"> <li>- Extracting water occurs for bananas not cane.</li> <li>- Draining the cane means diverted away from recharging the river</li> <li>- Originally floodplain would have been full of water. Not as much seepage over time in the past. The water gets channelled quicker – diverted the shallower part of the wetland. Due to laser levelling – now very flat and the water now runs straight off.</li> <li>- Laser levelling – has occurred in newer lands. Previously have sugar cane. Now present in the last 10 years due to laser levelling</li> </ul>	<p>Hymenachne in the feeder creek but not necessarily in the main channel.</p> <p>Paragrass is also here. Not much in the way of tree vegetation, mostly weeds</p> <p>Singapore daisy</p> <p>Riparian area minimal.</p> <p>Not much tree veg – only weeds</p> <p>Water quality monitoring – Tully water quality improvement plan.</p>	<p>Extensive riparian areas at foothills – soggy.</p>	<ul style="list-style-type: none"> <li>- Broadleaf tea tree – now been cleared.</li> <li>- Floods nearly every year.</li> <li>- Drains direct into the river. Wetland areas between agriculture – have an important role as well as connectivity.</li> <li>- Jungle perch in Barbed Wire Creek. Not all year around but do travel up there.</li> </ul>



**Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)**

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall and hydrological features	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
320 Barbed wire creek (South)	<p><b>Slopes</b> Up to 85m at headwaters of Barbed Wire Creek. Main channel is around 17m.</p> <p><b>Land Zones</b> Mostly - 3 (alluvium) main channel Some - 12 (Hills and lowlands on Granite rocks)</p> <p>Upper slopes steep, undulating area between there and the plug.</p> <p>Sloping foot hills, big boulders</p> <p>Picture showing wetlands held up behind granites plugs</p> 	<p>Large areas of:</p> <ul style="list-style-type: none"> <li>- Alluvium</li> </ul> <p>Small areas of:</p> <ul style="list-style-type: none"> <li>- mixed mafites and metamorphics (felsites) (mostly volcanic)</li> <li>- granite</li> </ul> <p>Granites – big intrusive at the base of mount in the middle with a large granite plug.</p> <p>Other side water runs off into deeper alluvium (area other side of road).</p> <p>Small alluvial area in the middle, area to the east, deeper active alluvium.</p>	<p>2000 – 2801mm/yr</p> <ul style="list-style-type: none"> <li>- Water is held up between the range and behind and the granite plug = melaleuca wetlands (see picture).</li> </ul>	<ul style="list-style-type: none"> <li>- Not really a major creek system.</li> <li>- The channels ill-defined in western part.</li> <li>- Previous ox bow – paleo feature.</li> <li>- Sandy banks and blowouts.</li> </ul> <p>Deep patches of water</p>	<ul style="list-style-type: none"> <li>- Groundwater recharge and discharge.</li> <li>- Shallow water table</li> </ul>	<p><u>Upper</u></p> <ul style="list-style-type: none"> <li>- Nature conservation 6.97%</li> </ul> <p><u>Lower</u></p> <ul style="list-style-type: none"> <li>- Cropping – sugar = 40.72%</li> <li>- Grazing native vegetation = 28.65%</li> <li>- Irrigated perennial horticulture = 13.31%</li> <li>- Other minimal use = 8.28%</li> </ul> <p>Active alluvium and cane coming in.</p> <p>bananas as well, drainage around cane</p>	<ul style="list-style-type: none"> <li>- Quite a lot of drainage.</li> <li>- This is changing the river dynamics (river can't loose energy so grabbing sediment from the other side of the bank which is farm land).</li> </ul>	<p><u>Upper</u></p> <ul style="list-style-type: none"> <li>- Patchy riparian and the whole area to west used for grazing.</li> <li>- Riparian better through agricultural area and to east of granite plug.</li> </ul>	<ul style="list-style-type: none"> <li>- <i>Melaleuca quinquenervia</i></li> <li>- <i>Melaleuca viridiflora</i> historically, now cleared</li> </ul>	<ul style="list-style-type: none"> <li>- Part of King Ranch.</li> <li>- Chemical fish barrier.</li> <li>- Very resilient area.</li> </ul>



**Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)**

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall and hydrological features	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
308 Timberoonie Creek Ten Mile Creek	<p><b>Slopes</b></p> <p>Steep slopes</p> <p>Up to 157m at the headwaters of Timberoonie Creek. Around 20m at the main channel.</p> <p><b>Land Zones</b></p> <p>Mostly</p> <ul style="list-style-type: none"> <li>- 12 (Hills and lowlands on Granite rocks)</li> <li>- 3 (alluvium) main channel</li> </ul> <p>Some</p> <ul style="list-style-type: none"> <li>- 8 (Basalt plains and hills)</li> </ul> 	<p>Large areas of:</p> <ul style="list-style-type: none"> <li>- Granite (upper)</li> <li>- Alluvium</li> </ul>	<p>2000 – 3201mm/yr</p> <p>Wetland Development</p>	<ul style="list-style-type: none"> <li>- Non-permanent</li> <li>- ill-defined channels</li> <li>- fast run off</li> <li>- bed rock controlled</li> <li>- confined</li> </ul>	<p>Alluvium, good surface to ground water interaction</p>	<p><u>Upper</u></p> <ul style="list-style-type: none"> <li>- Nature conservation =35.11%</li> </ul> <p><u>Lower</u></p> <ul style="list-style-type: none"> <li>- Grazing native vegetation =27.29%</li> <li>- Irrigated perennial horticulture (bananas) = 20.33%</li> <li>- Other minimal use =10.28%</li> <li>- Cropping – sugar =3.23%</li> <li>- Marsh/wetland = 1.07%</li> </ul>	<ul style="list-style-type: none"> <li>- Small reservoir dam</li> </ul>		<ul style="list-style-type: none"> <li>- Riparian is minimal.</li> </ul>	
281 A (upper) Jarra Creek	<p><b>Slopes</b></p> <p>Steep Slopes</p> <p>Up to 948m, 906m (Mount Cullumullum) several other peaks 868m (Mount Coleridge) 600m and 764m.</p> <p><b>Land Zone</b></p> <p>Mostly</p> <ul style="list-style-type: none"> <li>- 12 (Hills and lowlands on Granite rocks)</li> </ul> <p>Some:</p> <ul style="list-style-type: none"> <li>- 3 (alluvium) main channel</li> </ul>	<p><u>Upper in slopes</u></p> <p>Large areas of:</p> <ul style="list-style-type: none"> <li>- Granite either side</li> </ul> <p><u>Lower in alluvium</u></p> <p>V shape – alluvium starts</p> <ul style="list-style-type: none"> <li>- Sand formed alluvium area and areas of wetland.</li> <li>- Important alluvium areas last remaining area.</li> <li>- Small patch of basalt at the top</li> </ul>	<p>2401 – 4001mm/yr</p> <p>Largely natural hydrology.</p> <p>Waterholes throughout.</p>	<p><u>Upper in slopes</u></p> <ul style="list-style-type: none"> <li>- Fast run off</li> <li>- Creek at the top feeding creeks will ill-defined channels</li> <li>- Well connected</li> </ul> <p><u>Lower in alluvium</u></p> <ul style="list-style-type: none"> <li>- permanent</li> </ul>	<p><u>Upper</u></p> <ul style="list-style-type: none"> <li>- Minimal SW-GW recharge.</li> </ul> <p><u>Lower</u></p> <ul style="list-style-type: none"> <li>- Good SW-GW Recharge</li> </ul>	<p>Mostly:</p> <p><u>Upper</u></p> <ul style="list-style-type: none"> <li>- Nature conservation</li> <li>- Other minimal use</li> </ul> <p>Military use – from Tully gorge road to Jarra creek catchment Downey creek. Army training – lease from NPSR.</p>		<ul style="list-style-type: none"> <li>- Giant bramble present</li> </ul> <p><u>Upper</u></p> <p>Minimal natural riparian</p> <p><u>Lower</u></p> <p>Good riparian vegetation</p>	<ul style="list-style-type: none"> <li>- Largest remaining area of natural floodplain left and not developed in the Wet Tropics.</li> <li>- Large sub catchment</li> <li>- Along another fault line</li> <li>- Jungle perch all the way up.</li> </ul>	


Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)

										
<p>281 B (lower) Jarra Creek</p>	<p><b>Slopes</b> 25m above sea level.</p> <p><b>Land Zone</b> Mostly</p> <ul style="list-style-type: none"> <li>- 3 (alluvium)</li> </ul> 	<p>Large areas of:</p> <ul style="list-style-type: none"> <li>- Alluvium</li> </ul>	<p>2401 – 3201mm/yr</p>	<ul style="list-style-type: none"> <li>- River permanent</li> <li>- Well incised where Sandy Creek meets Jarra Creek.</li> <li>- Very active creek in some area migrating and moving, bringing sediment.</li> <li>- Channel getting sandy as alluvium forming</li> <li>- Channels well defined</li> <li>- Connections the whole way , significant fish values e.g. jungle perch – good connection to GBR.</li> </ul>	<ul style="list-style-type: none"> <li>- Good aquifers in alluvium.</li> </ul>	<p>Mostly:</p> <ul style="list-style-type: none"> <li>- Irrigated perennial horticulture (bananas).</li> <li>- Where Marquette Creek comes in - all bananas.</li> <li>- Historical gold mining in the foothills.</li> </ul>	<p>Lots of drainage channels</p>		<ul style="list-style-type: none"> <li>- Well defined minimum riparian</li> </ul>	<ul style="list-style-type: none"> <li>- Historical gold mining</li> <li>- Wetlands as it comes in to confluence.</li> </ul>



**Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)**

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall and hydrological features	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
281 C Lower Jarra Creek	<p><b>Slopes</b> Up to around 40m above sea level</p> <p><b>Land Zone</b></p> <p>Mostly: 3 (alluvium) main channel</p> <p>- Completely unstable area in terms of alluvial systems.</p> <p><b>Dingo pocket:</b></p>  <p>The confluence of Jarra:</p> 	<p>Large areas of: - Alluvium</p> <p>Alluvial area underneath – sand.</p> <p>Little bit of granite on western side.</p>	<p>2401-3201mm/yr</p>	<ul style="list-style-type: none"> <li>- Lower banks of Jarra Creek – no structure – lots of erosion slips and crumbles.</li> <li>- Highly convoluted section, lots of meanders and oxbows.</li> <li>- 15 years ago changed – snaking where it wants.</li> </ul> <p><u>Dingo Pocket (see photo)</u></p> <ul style="list-style-type: none"> <li>- River on top is two metres higher than below.</li> <li>- Evulsions can cause major damage and letting them go can cause problems.</li> <li>- Another system coming from NE/NW can see where it has cut through many times before.</li> </ul> <p><u>Confluence of Jarra (see photo)</u></p> <ul style="list-style-type: none"> <li>- River – has active area with lots of bends, which has broken through and been repaired again.</li> <li>- Highly mobile to the confluence. Two creeks coming together – very unstable.</li> </ul> <p>Channels broken in the past</p> <p>Active movement but not as much as Dingo Pocket.</p>		<p>Mostly:</p> <ul style="list-style-type: none"> <li>- Irrigated perennial horticulture (bananas) on eastern side</li> <li>- Cropping – sugar</li> <li>- Grazing on native vegetation</li> </ul> <p>Some:</p> <ul style="list-style-type: none"> <li>- Plantation forestry</li> <li>- Other minimal use</li> <li>- Very small area of residential and rural residential</li> </ul>	<ul style="list-style-type: none"> <li>- Dingo pocket - Lots of engineering to limit erosion and mobility.</li> <li>- At the end very unstable</li> </ul>		<ul style="list-style-type: none"> <li>- Minimal riparian as Jarra creek approaches the Tully.</li> <li>- Jarra Creek – into Tully River– no trees creek</li> </ul>	<ul style="list-style-type: none"> <li>- Classic alluvial area – would need to be very careful doing any kind of rehabilitation works</li> <li>- Number of systems coming together.</li> <li>- Any management intervention needs to be taken very carefully.</li> </ul>



**Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)**

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall and hydrological features	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
322 Echo Creek	<p><b>Slopes</b> Up to 54m above sea level</p> <p><b>Land Zones</b> Mostly - 3 (alluvium) main channel Some - 12 (Hills and lowlands on Granite rocks)</p> <p><u>Upper</u> - Area prone to slips due to steepness. - Bare areas – eroding??</p> <p><u>Middle</u> - Outside NP and into the lower area – start to get into the floodplain. - probably have a little granite underneath then into the more into floodplain with deep alluvium.</p> <p><u>Lower</u> - Eastern side of echo creek is flat, no elevation, high rainfall and all alluvial  - Very flat</p> 	<p>Large areas of: - Alluvium - Granite (half area)</p> <p>Small areas of: - mixed mafites nd metamorphics (felsites) (mostly volcanic)</p> <p>Water coming off from granites.</p>	2000 – 2801mm/yr	<ul style="list-style-type: none"> <li>- Long creek system running east from National Park.</li> <li>- ill-defined channels</li> <li>- flashy fast run off</li> <li>- Creek beds are big polished boulders.</li> <li>- Permanent flow – all year round.</li> <li>- A few fractured aquifers</li> <li>- Very unstable system.</li> <li>- Lots of natural barriers such as sand bars in this system</li> </ul> <p><u>Middle</u> - Lots of paelo channels, loops, bends, ox bows (showing where the system used to move in the past).</p> <p><u>Lower</u> - channel is deeply incised but it is totally unconfined so active migration is occurring and the river can move around wherever it likes.  - Swifter flowing.  - Lots of ox bows and other hydrological features.  - Paleo channels</p>	<p><u>Upper</u> No surface to groundwater interaction</p> <p><u>Lower</u> Water feeding into alluvium</p>	<p>Mostly: - nature conservation</p> <p>Echo Falls (10-15m high) just inside the National Park – large enough to act as a discriminating between the floodplain and upper catchment.</p> <p>some: - Other minimal use - Grazing native vegetation - Irrigated perennial horticulture (bananas) - Cropping – sugar</p> <p>Small area of: - Residential - Manufacturing and industrial  - Used to be logged years ago - Dozer tracks present.</p> <p><u>Lower</u> – - Along the main channel – development up until the edge of the creek.  - Buffer between agricultural areas and riverine system very minimal - no natural buffer to take chemicals out.  - Development right up to the sides of it.</p>	<ul style="list-style-type: none"> <li>- A lot of drainage.</li> <li>- A lot of groundwater being taken out by drains</li> <li>- During the dry seasons, there are 4-5 river crossings – manmade crossings.- detrimental at times.</li> </ul>	<ul style="list-style-type: none"> <li>- No filter strips drains pour water into the middle of the creek.</li> </ul>	<p><u>Upper</u> - Virtually no riparian - Siam weed in this area.  - As you move out of the National Park there are lot of bare areas.</p> <p><u>Middle</u> - Little bit of riparian in undulating area - seeing this trend the whole way down.</p> <p><u>Lower.</u> - No riparian at all the way down to the main trunk.</p> <p><u>Lower</u> - No paragrass on these sand bars  - Minimum to no riparian veg in the lower reaches.</p>	<ul style="list-style-type: none"> <li>- Minimal fish connectivity.</li> <li>- Waterfall near the end where it meets the flood plain.</li> <li>- This area also impacted badly by Yasi.</li> <li>- River Improvement Trust have done work in the past</li> <li>- Careful doing any re-vegetation work – could be completely undone by anything happening up stream. Re-vegetation can also cause blow outs in other areas.</li> </ul>


**Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)**

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall and hydrological features	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
327 A upper Davidson Creek North Branch Rockami Creek	<p><b>Slopes</b> Up to 902m at the headwaters of Davidson Creek.</p> <p><b>Land Zones</b> Mostly</p> <ul style="list-style-type: none"> <li>- 12 (Hills and lowlands on Granite rocks)</li> </ul> <p>Top showing fishtail:</p> 	<p>Large areas of:</p> <ul style="list-style-type: none"> <li>- Granite</li> </ul> <p>Some areas of:</p> <ul style="list-style-type: none"> <li>- Alluvium (at fishtail)</li> </ul>	2000 – 2801mm/yr	<ul style="list-style-type: none"> <li>- High flashy run off</li> <li>- Short., sharp</li> <li>- Permanent system</li> <li>- Main creek coming from the north and the other one coming from south east.</li> <li>- A lot of water running into this system</li> <li>- Connected system all the way through</li> </ul>	Good SW/GW	<p><u>Upper</u></p> <ul style="list-style-type: none"> <li>- Nature conservation =73.8%</li> </ul> <p><u>Lower</u></p> <ul style="list-style-type: none"> <li>- Other minimal use= 8.55%</li> <li>- Cropping – sugar = 5.06%</li> <li>- Grazing native vegetation =6.20%</li> <li>- Irrigated perennial horticulture = 6.18%</li> <li>- Headwater in National Park</li> </ul>	Minimal	<ul style="list-style-type: none"> <li>- Weeds – Siam all the way up.</li> <li>- Water quality – good.</li> </ul>	<ul style="list-style-type: none"> <li>- Minimal vegetation at the top naturally and well vegetated all the way through.</li> <li>- Good riparian in the fishtail.</li> </ul>	<ul style="list-style-type: none"> <li>- Waterfalls in the middle</li> <li>- Old stock route running through it.</li> <li>- Jungle Perch right to the top.</li> <li>- Shape of private property and the way the rivers come in named as = fish tail.</li> </ul>
327 B middle Davidson Creek	<p><b>Slopes</b> Up to 836m</p> <p><b>Land Zones</b> Mostly</p> <ul style="list-style-type: none"> <li>- 12 (Hills and lowlands on Granite rocks)</li> <li>- 3 (alluvium) main channel</li> </ul> <p>Channel fairly flat and undulating - Hit the creek line goes into the flatter area.</p> 	<ul style="list-style-type: none"> <li>- Alluvium with underlying granites</li> </ul> <p>Deeper alluvium with agriculture in these areas.</p>	2000 – 2401mm/yr  Connectivity to the National Park to the west	<ul style="list-style-type: none"> <li>- Cobbles and boulders in this area.</li> <li>- Permanent creek</li> </ul>	Good SW-GW	<p>Mostly:</p> <ul style="list-style-type: none"> <li>- Other minimal use</li> <li>- Grazing native vegetation to the foothills.</li> <li>- Forestry back to pasture</li> <li>- Used to have grazing now growing sugar cane and banana's lower to the river.</li> </ul> <p>Grazing on west side and intensive agriculture on the east side.</p>	<ul style="list-style-type: none"> <li>- No major barrier for fish movement but lots of smaller barriers.</li> </ul>	<ul style="list-style-type: none"> <li>- Weeds – Siam all the way up and in the cleared area.</li> </ul>	<ul style="list-style-type: none"> <li>- Good riparian area in fish tail part.</li> </ul>	<ul style="list-style-type: none"> <li>- A lot of water running into this system</li> <li>- This system would lend itself more to systems repair.</li> </ul>


**Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)**

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall and hydrological features	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
327 C lower Davidson Creek Several unnamed creeks	<p><b>Slopes</b> Up to 39m round 14m at the main channel of the Tully River.</p> <p><b>Land Zones</b> Mostly - 3 (alluvium) main channel Some - 12 (Hills and lowlands on Granite rocks)</p> <p>Big catchment and from the west.</p> <p>- From Munro Hill the creek is quite unstable and lots of rock work happening – by shed cuts straight through.</p> <p><b>Munro Hill:</b></p>  <p><b>Photo showing paleo channels:</b></p> 	<p>Large areas of:</p> <ul style="list-style-type: none"> <li>- Alluvium (lower end)</li> </ul> <p>Small areas of:</p> <ul style="list-style-type: none"> <li>- Granites</li> </ul> <p>Active alluvium</p> <p>Water diverts around the granite intrusion (Munro Hill).</p> <p>very deep creeks</p> <p>very deep incised terraces</p>	<p>2000 – 2401mm/yr</p> <p>Lots of water in the system.</p> <p><u>Lower</u></p> <ul style="list-style-type: none"> <li>- Bits of wetland, little channels running through it.</li> </ul>	<ul style="list-style-type: none"> <li>- Permanent system – to Tully from alluvium</li> <li>- Wide incised channels from the creek bank on the western side. Points on Davidson Creek have 20m vertical banks</li> <li>- big flat terraces</li> </ul> <p><u>Lower</u></p> <ul style="list-style-type: none"> <li>- End of Davidson Creek – paleo channels appear.</li> <li>- Collapsing and becoming rock walled. Whole area for Davidson into the Tully very unstable – moving around.</li> <li>- Paleo channels present</li> <li>- Part of this can connect to the Murray.</li> </ul>		<p>Mostly:</p> <ul style="list-style-type: none"> <li>- Irrigated perennial horticulture (bananas)</li> <li>- Cropping -sugar</li> </ul> <p>Small area of</p> <ul style="list-style-type: none"> <li>- Grazing native vegetation (foothills)</li> <li>- Residential</li> </ul> <p>Agricultural areas on the eastern side on the creek.</p> <p>Fully developed with cane and bananas.</p>	<ul style="list-style-type: none"> <li>- No major barriers.</li> <li>- Lots of drainage – watershed area</li> <li>- The whole system where Davidson Creek runs into the Tully has been constantly reworked.</li> </ul>	<ul style="list-style-type: none"> <li>- Weeds – Siam weed all the way up.</li> <li>- Fish movement – jungle perch healthy with fish the water quality is good.</li> <li>- Water improvement plan reference site.</li> <li>- Natural system between agriculture and the creek protecting the water quality to a certain extent.</li> </ul>	<ul style="list-style-type: none"> <li>- Lower areas more riparian - a bit more of the natural system still left in place.</li> </ul>	<ul style="list-style-type: none"> <li>- Crocodiles – all the way up to power station and fish tail.</li> <li>- Barramundi present.</li> </ul>


**Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)**

LOWER TULLY										
Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall and hydrological features	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
319 Travelling Dairy Creek	<p><b>Slopes</b> Up to 202m at the headwaters of the Travelling Dairy Creek. Other peaks at 171m, 46m and 21m</p> <p><b>Land Zones</b> Mostly</p> <ul style="list-style-type: none"> <li>- 3 (alluvium) main channel</li> <li>- 12 (Hills and lowlands on Granite rocks)</li> <li>-</li> </ul>	<p>Large areas of:</p> <ul style="list-style-type: none"> <li>- Alluvium</li> <li>- Granite</li> </ul> <p>Small sub catchment – different – granites all around it and wetlands at the base of where the granites are and sitting in shallow alluvium and water runs of = wetlands formed.</p> <p>Extruding granite each side and holding the water up in in the system themselves.</p> <p>Granite tongue</p>	2401 – 3201mm/yr  Melaleuca swamp	<ul style="list-style-type: none"> <li>- Minimal channels – wet areas drained.</li> <li>- Water sitting in shallow alluvial area.</li> </ul>	<ul style="list-style-type: none"> <li>- Lots of groundwater interaction.</li> <li>- Shallow aquifer</li> </ul>	<p>Mostly:</p> <ul style="list-style-type: none"> <li>- Cropping – sugar Irrigated</li> <li>- Irrigated perennial horticulture</li> <li>- Other minimal use</li> </ul> <p>Some:</p> <ul style="list-style-type: none"> <li>- Residential</li> </ul>	Canals – significant drainage on the western side of granite ridge.	- Lower section of Travelling Dairy Creek has been identified as a hotspot for TSS. (WQIP 2015)	- minimal riparian	<ul style="list-style-type: none"> <li>- Tea tree swamp all the way through.</li> <li>- Area runs into Jarra Creek but has its own sub catchment.</li> <li>- Granites with wetlands at the base</li> </ul>
<p>Main channel from 319 to 332 (mouth)</p> <p><i>Lower Tully</i></p>	<p>Picture showing main channel:</p> 	Large area of Alluvium	2401-3201 mm/yr	<ul style="list-style-type: none"> <li>- Permanent</li> <li>- Natural levees running through = high bank.</li> <li>- 2-3 m banks and actively eroding. A head cut will form if hole eats the banks upstream to find its level again to balance itself</li> </ul> <p><u>Lower</u> River main channel from Rockingham Road down_</p> <ul style="list-style-type: none"> <li>- Highly mobile</li> <li>- 2-3 m high banks</li> <li>- deep water 7-10 m</li> <li>- Incised</li> <li>- Lots of sand bars</li> <li>- Sand bars and spits</li> </ul>	Lots of ground water discharge.	<ul style="list-style-type: none"> <li>- Bananas (irrigated perennial horticulture)</li> </ul>	<p>No significant infrastructure</p> <p>Sand extraction (Tully Heads)</p>		- Minimal riparian but good towards the coast.	


**Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)**

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall and hydrological features	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
324 Flat area with multiple unnamed creeks	<p><b>Slopes</b> Up to 27m at the peak next to the setting ponds.</p> <p><b>Land Zones</b> Mostly - 3 (alluvium) main channel Some - 12 (Hills and lowlands on Granite rocks)</p> <p>Minimal slopes.</p> <p>Open grassy wetland area in lower</p> <p>Flat in lowland, drop in elevation to a basin, issues with erosion associated with straightening the drains near the foothills</p> <p><b>Image of flat areas showing extensive drainage lines:</b></p> 	<p>Large areas of:</p> <ul style="list-style-type: none"> <li>- Alluvium</li> </ul> <p>Also contains an area of granite</p> <p>Very flat and so very prone to flooding due to alluvium with granite underneath so no drainage = Very wet area.</p> <p>Alluvium underlain by granites</p>	<p>2801 – 4001mm/yr</p> <p>When Tully overflows, floods the whole area</p>	<p><u>Upper</u></p> <ul style="list-style-type: none"> <li>- Channels not well defined (No real creek system running through this area).</li> <li>- Lots of different smaller creeks</li> </ul>	<p>Lot of groundwater and surface water interaction with peat soils.</p> <p>Transition zone</p>	<ul style="list-style-type: none"> <li>- Nature conservation = 13.61% (on granites)</li> <li>- Cropping – sugar = 62.2% (foothills)</li> <li>- Other minimal use= 10.32%</li> <li>- Grazing native vegetation = 9.04%</li> <li>- Irrigated perennial horticulture (Mangoes) = 1.71%</li> <li>- Flood plain – all free hold.</li> <li>- Cane and a bit of grazing and bananas on Tully River bank on loamy soils.</li> </ul>	<p>Sandy creek major (drain) with black peat soils all around.</p> <p>A lot of drainage lines going through, but still a lot of water.</p> <p>Large syndicate council drain through area to open the area up. Photo opposite shows an extensive drainage network.</p> <p>Sugar mill settlement ponds.</p> <p>development up to channel</p> <p>Small reservoir/dam</p>	<ul style="list-style-type: none"> <li>- In the middle there is a basin of residual wetlands having an impact on water quality coming off cane land.</li> <li>- Landfill in foothills, has issues with foothill springs and sugar mill holding ponds lower down.</li> <li>- Quite a bit of isolated wetlands throughout it - Probably quite a bit of water treatment happening in those small patches of wetlands.</li> </ul>	<ul style="list-style-type: none"> <li>- Minimal riparian</li> </ul> <p><u>Historically</u></p> <ul style="list-style-type: none"> <li>- Lowland open forest with a complex mosaic of vegetation communities such as vine forest, blady grass, <i>Melaleuca viridiflora</i> and quinquenervia blood wood, stringy bark and red gum.</li> </ul> <p><u>Main channel</u></p> <ul style="list-style-type: none"> <li>- No vegetation, sand bars with para grass = erosion on banks the other side.</li> </ul>	<ul style="list-style-type: none"> <li>- Highly modified sub catchment</li> <li>- Where Banyan Creek comes in, Tully River cut through to reduce flooding in Euramo, shortened the river and head cut extends upwards.</li> </ul>


**Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)**

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall and hydrological features	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
301 A Upper  Derra Creek Boulder Creek Campbell Creek Meerang Creek Bulgan Creek Wunga Creek Stony Creek	<p>Land surrounding channels – slopes, soil, erosion type</p> <p><b>Land Zones</b></p> <p>Steep</p> <p>Mostly - 12 (Hills and lowlands on Granite rocks)</p> <p>Some - 11 (Hills and lowlands on metamorphic rock) - 3 (alluvium) main channel</p> <p>Floodplain on eastern side</p> 	<p>Mostly</p> <ul style="list-style-type: none"> <li>- Granite</li> </ul> <p>Some</p> <ul style="list-style-type: none"> <li>- Alluvium</li> <li>- Mudrock (are dominant rocks under the far eastern mountains).</li> </ul> <p>Range – metamorphic (Devonian mudstone/sandstone)</p> <p>Vey sharp, older, more weathered.</p>	<p>2801 – 4801mm/yr</p> <p>Very wet area near slump</p>	<ul style="list-style-type: none"> <li>- High energy, fast</li> <li>- Permanent</li> <li>- Large boulders</li> <li>- Water holes at lower end (Tyson walking track).</li> <li>- Sandy</li> <li>- Good connections into rainforest</li> <li>- Fully connected system.</li> </ul>	<ul style="list-style-type: none"> <li>- Groundwater fed</li> <li>- Lower transmissivity of the soil.</li> </ul>	<p>Mostly:</p> <ul style="list-style-type: none"> <li>- Nature conservation</li> <li>- Other minimal use</li> </ul> <p>Some:</p> <ul style="list-style-type: none"> <li>- Residential</li> </ul> <p>Forest degraded due to cyclones, privately owned and subdivided into rural blocks.</p> <p>Headwaters of Banyon – some National Park.</p>	<ul style="list-style-type: none"> <li>- Small sump on Bulgan Creek and Moongera Creek holding about a mega litre small natural weir. This forms a water supply and is pumped in the low dry season. Water is gravity fed – into a small area and treated. (see picture)</li> </ul>		<ul style="list-style-type: none"> <li>- Minimal riparian once it has left the National Park and moved into the village.</li> <li>- Town water supply is from the upper areas of the National Park.</li> <li>- Fish – jungle perch –</li> <li>- Tanks on the Tully reservoirs – no pumping involved so they can obtain water in the dry season.</li> </ul>	
301 B Lower  Boulder Creek Banyon Creek Djarawong Creek Moongera Creek Bumpbucal Creek Hobans Creek Merryburn Creek Little Banyob Creek	<p><b>Slopes</b></p> <p>Around 55m above sea level</p> <p><b>Land Zones</b></p> <p>Mostly</p> <ul style="list-style-type: none"> <li>- 3 (alluvium) main channel</li> </ul> <p>Some</p> <ul style="list-style-type: none"> <li>- 12 (Hills and lowlands on Granite rocks)</li> <li>- 11 (Hills and lowlands on metamorphic rock)</li> </ul>	<p>Mostly</p> <ul style="list-style-type: none"> <li>- Alluvium</li> </ul> <p>Some</p> <ul style="list-style-type: none"> <li>- Granite</li> <li>- Mudrock</li> </ul> <p>Areas on western side more free flowing with sandy soils.</p> <p>Large area of flood plain and granites.</p> <p>Soil in the east less sandy – more mudstone.</p> <p><u>Below Tully</u></p> <ul style="list-style-type: none"> <li>- Horseshoe – cut out</li> </ul>	<p>2801 – 4801mm/yr</p> <ul style="list-style-type: none"> <li>- Eastern side – due to the run off from mud stone – finer grain material gets generated = clay material in floodplain – holds water more and creates wetlands.</li> <li>- Bottom section fills with water – 6 m above the Hull. Transmissivity of soil low – has mud in it (can't suck water out).</li> </ul>	<ul style="list-style-type: none"> <li>- Head cut on 301 – feeding back up through the river.</li> <li>- Western side areas more free flowing than east</li> <li>- Banyon Creek depth – well incised, unconfined and permanent.</li> <li>- Two creeks together – called Banyon all the way to Tully.</li> </ul>	<p>Whole area ground water fed</p> <p>Soils very sandy and porous and hold back a lot of water. (Bunya and Banyan to right eastern side)</p> <p>Good SW-GW</p>	<p>Mostly:</p> <ul style="list-style-type: none"> <li>- Cropping sugar</li> </ul> <p>Some:</p> <ul style="list-style-type: none"> <li>- Nature conservation (Banyan on eastern side coming off national park in parts)</li> <li>- Residential</li> <li>- Intensive animal production (aquaculture )</li> <li>- grazing</li> </ul> <p>Small area of:</p> <ul style="list-style-type: none"> <li>- Mining</li> <li>- Recreation and culture</li> </ul>	<ul style="list-style-type: none"> <li>- There are lots more drainage lines through this area.</li> <li>- Sewage treatment plant - holding capacity –currently looking at alternatives.</li> <li>- Below Tully - Council reserve – activity drained on right hand side and runs into it.</li> <li>- Sand removal – extraction all the way down the river. Permits certain sections they can extract from.</li> </ul>	<p>Sewage treatment plant – tertiary. Only problems in wet season storm water infiltration (south/ east of town).</p> <ul style="list-style-type: none"> <li>- Sugar mill – closed system (keep in house) then gets pumped into settling ponds on 324. This has a temperature effect</li> </ul>	<ul style="list-style-type: none"> <li>- Banyon creek – lack of riparian vegetation.</li> <li>- Below Tully town - Little riparian.</li> </ul>	<ul style="list-style-type: none"> <li>- Tully Town</li> <li>- Wetland</li> <li>- Good connections for catadromous fish.</li> <li>- Banyon – Tilapia.</li> <li>- Smith's gap – only place left corridor for cassowaries. (See picture)</li> <li>- Forest a lot more degraded from cyclones and privately owned</li> </ul>

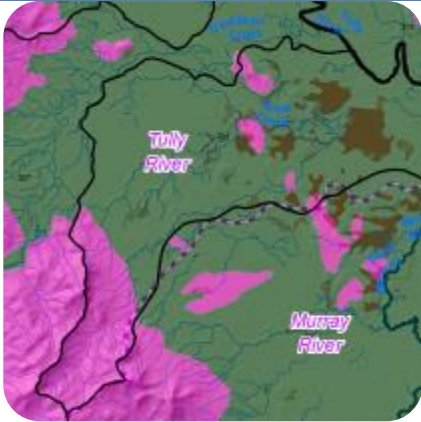


**Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)**

			<ul style="list-style-type: none"> <li>- Patches of swamp</li> </ul>			<p>In Banyan, lots of rural residential and hobby farms – this has implications for weeds etc.</p> <ul style="list-style-type: none"> <li>-</li> </ul> <p><u>Below Tully</u> Low terrace – gallery range rainforest.</p> <p>Small bit of cane land draining - fills up in the wet season and feed back into the river.</p>		<p>from the cooling towers. The mill comes out at Banyon Creek.</p>		
<p>328</p> <p>Parts of the Hull River</p> <p>Silky Oak Creek</p> <p>Carnie Creek</p>	<p><b>Slopes</b> Up to 724m (Mount Mackay) at the headwaters of Silky Oak Creek (split between 3 sections).</p> <p>Upper – steep slopes</p> <p>Lower - Clay</p> <p><b>Land Zones</b> Mostly</p> <ul style="list-style-type: none"> <li>- 3 (alluvium) main channel</li> <li>- 12 (Hills and lowlands on Granite rocks)</li> </ul> <p>Large area with no major channels similar to 324 – fast run off with no major drainage and very wet.</p> 	<p>Large areas of:</p> <ul style="list-style-type: none"> <li>- Alluvium</li> <li>- Granite</li> </ul> <p>Granite boulders and spongy clay.</p> <p>River natural levee too high.</p>	<p>2801 - 4001mm/yr</p> <ul style="list-style-type: none"> <li>- Upper limits of tidal reaches of the Tully to halfway through this sub catchment</li> </ul>	<p><u>Upper</u></p> <ul style="list-style-type: none"> <li>- Fast run off - runs straight off</li> <li>- ill-defined channels</li> <li>- Silky Oak Creek permanent – shallow, sandy.</li> </ul> <p><u>Lower</u></p> <ul style="list-style-type: none"> <li>- Slips on main channel. Stable into unstable.</li> </ul>	<p>Lots of groundwater</p>	<p><u>Upper</u> – Mt Mackay in the National Park in the high area</p> <p>Nature conservation = 34.37%</p> <p><u>Lower</u></p> <ul style="list-style-type: none"> <li>- Cropping – sugar = 54.03%</li> <li>- Other minimal use = 6.05%</li> <li>- Grazing native vegetation = 1.31%</li> <li>- Residential = 1.31%</li> </ul> <p>Motorcross park in the reserve</p>	<p>Not quite as wet as other areas, but still quite heavily drained (see pic).</p> <p>3 quarries on hill slope.</p>		<p><u>Upper:</u></p> <ul style="list-style-type: none"> <li>- Creek lines – minimal riparian</li> <li>- Slope coming down – free hold has been left vegetated.</li> <li>- Revegetation happening.</li> </ul> <p><u>Lower</u></p> <ul style="list-style-type: none"> <li>- Flood plain – riparian disappears minimal</li> <li>- Carnie creek – re veg the canal.</li> </ul>	<ul style="list-style-type: none"> <li>- Small area of marsh/wetland</li> <li>- Tilapia in the creek.</li> <li>- Silky Oak Creek entrance to Tully – tidal limit and where it fluctuates</li> </ul>



**Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)**

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall and hydrological features	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
331 Top (1) <i>(Upper)</i>  Several unnamed creeks	<p><b>Slopes</b> Up to approximately 676m. Other peaks at 32m, 25, and 106m on the main plain.</p> <p><b>Land Zones</b> Mostly</p> <ul style="list-style-type: none"> <li>- 12 (Hills and lowlands on Granite rocks)</li> </ul>	<p>Large areas of:</p> <ul style="list-style-type: none"> <li>- Granite</li> </ul> <p>Although variable the Tully has high levies so water tends to flow back.</p>	2000 - 3201mm/yr	<ul style="list-style-type: none"> <li>- Small creek systems making up the sub catchments</li> <li> </li> <li>- Floodplain between Murray River and the Tully.</li> </ul>		<p>Mostly:</p> <ul style="list-style-type: none"> <li>- Nature conservation</li> <li>- Girramay National Park.</li> </ul>	Drainage			
331 (2) <i>(Drainage)</i>  Brick Creek  Boundary Creek  Boar Creek	<p><b>Slopes</b></p> <p><b>Land Zones</b> Mostly:</p> <ul style="list-style-type: none"> <li>3 (alluvium)</li> </ul> <p>Some:</p> <ul style="list-style-type: none"> <li>12 (Hills and lowlands on Granite rocks)</li> </ul> <p>Surface flows – low elevations</p> <p>More clay in the soils</p> <p>Underlying granite</p> <p>Tully fault creates some separation towards the coast but in from the coast there is probably a division in the alluvium keeping them separate. See picture below</p> <p>Pictures below showing wetlands held up underneath the granite.</p> 	Large areas of alluvium	2000 - 3201mm/yr	<ul style="list-style-type: none"> <li>- Ill defined</li> <li>- Bore creek fast runoff in the upper part</li> <li>- channel unconfined meanders,</li> <li>- Channel for bore and boundary through black clay, small, well defined</li> <li>- Permanently wet system</li> <li>- Connection right through the system</li> </ul>	lots of groundwater and surface water interaction	<p>Mostly:</p> <ul style="list-style-type: none"> <li>- Cropping – sugar</li> <li>- Grazing native vegetation</li> </ul> <p>Some:</p> <ul style="list-style-type: none"> <li>- Nature conservation</li> <li>- Irrigated tree fruits</li> <li>- Other minimal use</li> </ul>	<p>Heavily drained Major cane with significant drainage</p> <p>Majority drains into the Murray.</p>	<ul style="list-style-type: none"> <li>- Weeds, wide range of species and abundant.</li> <li>- In the dry the wetland really suffers because drainage altered.</li> </ul>	<ul style="list-style-type: none"> <li>- Riparian minimal to non-existent</li> </ul>	<ul style="list-style-type: none"> <li>- Consolidated landholders.</li> <li>- Important for refuge and critical for flood plain ecology.</li> <li>- Table drain picks up water in bore creek, lagoon in low flow goes to Murray the lagoon is south of Jalum then in the west towards the Tully through Brick and Boundary Creek.</li> </ul>


Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)

	 <p>Lagoons shown in red circles:</p> 									
<p>331 (3) Euramo area Weiss Creek</p>	<p><b>Slopes</b></p> <p><b>Land zones</b></p> <p>Mostly: 3 (alluvium)</p> <p>An area of trans basin connectivity more across between the two.</p> 	<p>- Majority of this area drains back into the Murray system – south.</p>	<p>2000 - 3201mm/yr</p>	<ul style="list-style-type: none"> <li>- Channels, drainage cane.</li> <li>- Weiss Creek flows both ways and connects with the Murray (depending on which river is up at the time).</li> <li>- Water down bore and boundary – small creeks</li> <li>- Dry season flow into the Murray. Wet season flow into the Tully.</li> </ul>	<p>Halfway along Rockingham road is a small rise that divides the Tully and the Murray, groundwater divide.</p>	<p>Mostly:</p> <ul style="list-style-type: none"> <li>- Cropping – sugar</li> </ul> <p>Some:</p> <ul style="list-style-type: none"> <li>- Nature conservation</li> </ul> <p>Small area of residential</p> <p>BMX track</p>			<ul style="list-style-type: none"> <li>- Some decent riparian along the main Tully river in this area.</li> </ul>	<ul style="list-style-type: none"> <li>- Barramundi and Tarpon through the system.</li> <li>- Special fish habitat.</li> <li>- Orchard Creek east Euramo drainage board is consolidated.</li> </ul>

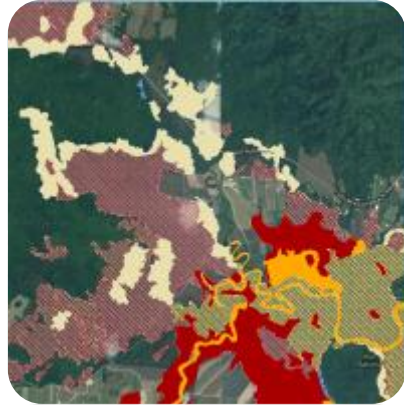

**Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)**

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall and hydrological features	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
331 (4) (coastal)	<p><b>Slopes</b></p> <p><b>Land zones</b></p> <ul style="list-style-type: none"> <li>- 1 (Tidal flats and beaches)</li> <li>- 2 (Coastal dunes)</li> </ul> <p>Some:</p> <ul style="list-style-type: none"> <li>- 3 (alluvium)</li> </ul> <p>Ridges and swale all the way through</p> <ul style="list-style-type: none"> <li>- Sand plug – (own aquifer) water runs around them not through.</li> <li>- Sand plug forcing barrats to be deeper, water across the lagoon but not through.</li> <li>- Black sand</li> </ul> <p>Picture showing floods:</p>  <p>Picture showing swale.</p> 	<p>Large areas of :</p> <ul style="list-style-type: none"> <li>- Sand</li> <li>- Alluvium</li> </ul> <p>Some areas of:</p> <ul style="list-style-type: none"> <li>- Mud</li> <li>- Miscellaneous unconsolidated sediments</li> </ul>	<p>2000 - 3201mm/yr</p> <ul style="list-style-type: none"> <li>- Barretts Lagoon</li> <li>- Deep lagoon (7m in depth on average).</li> <li>- Sand - Not a true flow of water – acts as a reservoir of water and supports GDE's.</li> <li>- Freshwater wetlands in dune system</li> <li>- Wetlands in swale – (wetlands building up behind the fault line).</li> </ul>	<ul style="list-style-type: none"> <li>- Creeks through main channel rather than through the sand.</li> </ul>	<ul style="list-style-type: none"> <li>- Little aquitards – water runs through the sand form perch areas.</li> <li>- GDE's</li> <li>- Good SW to GW interaction.</li> </ul>	<p>Mostly:</p> <ul style="list-style-type: none"> <li>- Nature conservation</li> </ul> <p>Some:</p> <ul style="list-style-type: none"> <li>- Other minimal use</li> <li>- Grazing native vegetation</li> </ul> <p>Small area of</p> <ul style="list-style-type: none"> <li>- Residential</li> <li>- Cropping - sugar</li> </ul>	<p>Drainage channels and cane</p>	<p>Wetlands affected by hymeachne.</p>	<ul style="list-style-type: none"> <li>- Coast – vegetation creeks to the west no vegetation.</li> <li>- Mosaic of lowland open forest, melaleuca, mangrove</li> </ul>	<ul style="list-style-type: none"> <li>- Fish migrate out of Barrats lagoon to Tully Lagoon. Empire Gudgeon and Hardy head.</li> <li>- Cyclone and storm surge effected.</li> <li>- Arthington et al 2014 found that Barrett's Lagoon (close to the river mouth) contained a greater proportion of species (52%) that need access to saline environments compared to lagoons upstream.</li> </ul>


**Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)**

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall and hydrological features	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
332  Several unnamed Creeks  (Tully Heads)	<p>Up to 9m at the main channel</p> <p><b>Slopes</b></p> <p><b>Landzones</b></p> <p>Mostly:</p> <ul style="list-style-type: none"> <li>- 3 (alluvium)</li> </ul> <p>Some:</p> <ul style="list-style-type: none"> <li>- 2 (coastal dunes)</li> <li>- 1 (tidal flats and beaches)</li> </ul> <p>From the Rockingham Road to the mouth, it is a really unstable.</p>  <p>332 and 321 separate – drains different</p>	<p>Mostly:</p> <ul style="list-style-type: none"> <li>- Alluvium</li> </ul> <p>Some:</p> <ul style="list-style-type: none"> <li>- Sand</li> <li>- Mud</li> <li>- Miscellaneous unconsolidated sediments</li> </ul> <p>Some clay in this area (a lens from 8-16metres) this is holding the water in the system.</p>	<p>2401 – 3201mm/yr</p> <ul style="list-style-type: none"> <li>- Too much water for large estuarine area</li> <li>- Not an extensive estuarine area for the river itself.</li> <li>- Freshwater pushing out the whole time</li> <li>- Wetland formation on the eastern side held up by the clay</li> <li>- Freshwater wetland formation – eastern side off the back of the dune system.</li> </ul>	<ul style="list-style-type: none"> <li>- No real creek systems – all developed area.</li> <li>- Banks – 2-3m (very incised)</li> <li>- Big bends hitting clay banks so digging in.</li> <li>- Sand bar across it</li> </ul>		<ul style="list-style-type: none"> <li>- Cropping sugar = 47.23%</li> <li>- Marsh/wetland = 19.15%</li> <li>- Nature conservation (Hull River National Park ) 12.77%</li> <li>- Other minimal use = 10.54%</li> <li>- Residential = 6.29%</li> <li>- Land in transition = 2.41%</li> </ul>	<ul style="list-style-type: none"> <li>- Shallowed out at mouth and silted up – sand</li> <li>- Drains throughout</li> </ul>		<ul style="list-style-type: none"> <li>- No riparian</li> <li>- Bamboo found here</li> </ul> <p><u>Lower</u></p> <ul style="list-style-type: none"> <li>- Mangrove encroachment of the river</li> <li>- Mangrove s up to near where the wetland is.</li> </ul>	<ul style="list-style-type: none"> <li>- Closer it gets wetter.</li> <li>- Beach constrains by sand spits.</li> <li>- Tully heads on community septic</li> </ul>


**Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)**

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall and hydrological features	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
321 Upper Carmoo Creek Sugarcane Creek Condoi Creek Bovril Creek	<p><b>Slopes</b>                      Up to 724m (Mount Mackay) split between 3 sections. Mount Coom 104m Mount Douglas 339m</p> <p>Ranges aren't steep apart from Mount Mackay</p> <p>Rainforest on slopes to the reef</p> <p><b>Land Zones</b>                      Mostly</p> <ul style="list-style-type: none"> <li>- 12 (Hills and lowlands on Granite rocks)</li> </ul> <p><u>Carmoo Ck –</u></p> <ul style="list-style-type: none"> <li>- Elevated on a hill</li> <li>- White clay – peated drainage - White clay base layer under the freshwater wetlands.</li> </ul> <p>Fines in the foothills</p> <p>Pictures showing wetlands at the base of the mountains.</p>  <p>The same area above without the wetlands mapping layer on.</p> 	<p>Different geology. Metamorphics at north</p> <p>Large areas of:</p> <ul style="list-style-type: none"> <li>- Alluvium (shallow off mountains)</li> </ul> <p>Small patches of:</p> <ul style="list-style-type: none"> <li>- Arenite-mudrock</li> <li>- Sand</li> </ul> <p>Small areas of:</p> <ul style="list-style-type: none"> <li>- Granite</li> </ul> <p>Different geology</p>	<p>2401 – 4801mm/yr</p> <p>(Slightly lower rainfall)</p> <p>Lots of wetlands</p> <ul style="list-style-type: none"> <li>- Continuum the whole way through (a few river systems from source to sea largely protected). Marine environment to Mt Mackay. Few river systems that are source to sea and are protected.</li> <li>- Wetland areas on base.</li> <li>- Dynamic system between fresh and salt water/estuarine.</li> </ul>	<ul style="list-style-type: none"> <li>- Connected systems</li> <li>- Linear features</li> <li>- metamorphics different in drainage lines.</li> <li>- Streams fast run off – not the same high energy streams as the rest of the catchment lower altitude and lower rainfall.</li> </ul> <p><u>Lower</u></p> <ul style="list-style-type: none"> <li>- Creeks are near permanent</li> <li>- Semi confined system.</li> <li>- Deep channel high bank</li> <li>- Channel moves around a lot.</li> </ul>	<ul style="list-style-type: none"> <li>- Ground water fed through system.</li> <li>- A few permanent creeks and a lot of seasonal that turn to water holes (these waterholes never dry out).</li> <li>- Good SW-GW.</li> </ul>	<p>Mostly:</p> <ul style="list-style-type: none"> <li>- Nature conservation</li> </ul> <p>Mount Mackay National park</p> <p>Hull River National Park</p> <p>Djiru National Park</p> <p>(Extensive National Parks all the way through)</p> <p>Some:</p> <ul style="list-style-type: none"> <li>- Cropping – sugar</li> <li>- Other minimal use</li> </ul>	<ul style="list-style-type: none"> <li>- No barriers e.g. waterfalls. Particularly on eastern side</li> <li>- Cleared area in the foothills that used to be a lagoon but has been drained.</li> </ul>		<ul style="list-style-type: none"> <li>- Broad leaf tea tree present.</li> <li>- A mosaic of different ecosystems, including palm, lowland rainforest, melaleuca and lowland open forest.</li> </ul>	<ul style="list-style-type: none"> <li>- Jungle perch found here - connective system and breeding system right through</li> <li>- Crocodiles.</li> <li>- Breeding habitat throughout</li> </ul>

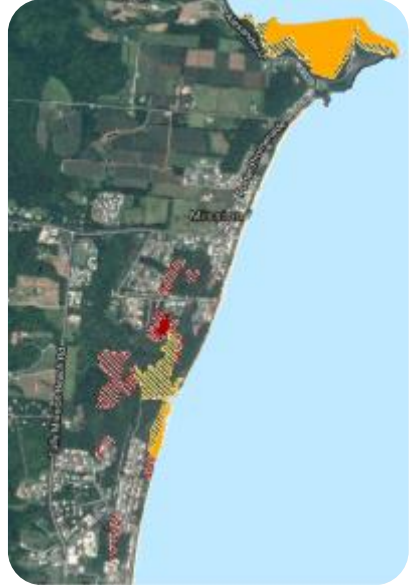
**Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)**

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall and hydrological features	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
321 -4 Middle Hull River	<p><b>Slopes</b></p> <p>Up to 104m at Mt Coom</p> <p><b>Landzones</b></p> <p>Mostly</p> <ul style="list-style-type: none"> <li>- 3 (alluvium)</li> </ul> <p>Some:</p> <ul style="list-style-type: none"> <li>- 2 (coastal dunes)</li> <li>- 1 (Tidal flats and beaches)</li> </ul> <p>Carmoo on a more elevated area, wetland areas at the base.</p> <p>Gentle topography</p> <p>Catchment much smaller than the Tully</p> 	<p>Mostly</p> <ul style="list-style-type: none"> <li>- Alluvium</li> </ul>	<p>2401 – 3201mm/yr</p> <ul style="list-style-type: none"> <li>- This area gets significant flooding from Tully during high flow events.</li> <li>- Much more extensive estuarine area</li> <li>- Hull River to east, and then joins with The North Hull river coming from the north. Then they meet.</li> <li>- At base of mountain have a huge amount of wetland development.</li> <li>- Small areas of salt pan around Mt Coomb</li> </ul>	<ul style="list-style-type: none"> <li>- Semi confined system for main channel of the Hull.</li> <li>- Hull river bifurcates</li> <li>- Northern hull – unconfined, meanders, sits in the fault shear.</li> <li>- more low energy</li> <li>- Good connections to the reef</li> </ul>	<p>GDE's throughout</p>	<p>Mostly:</p> <ul style="list-style-type: none"> <li>- Nature conservation</li> <li>- Irrigated perennial horticulture (cane).</li> <li>- Other minimal use</li> <li>- The headwaters run through cane area and into the Hull – connection through to cane farms in a heathy system.</li> </ul>	<ul style="list-style-type: none"> <li>- Lots of drainage in this area.</li> <li>- Floodgates off the cane into the hull - stops the saltwater pushing up into cane.</li> <li>- Cleared area in the foothills that used to be a lagoon but has been drained.</li> </ul>		<ul style="list-style-type: none"> <li>- Lots of mature mangrove development</li> <li>- <i>Melaleuca viridiflora</i> and <i>quinquenervia</i></li> <li>- Healthy mangroves in the Hull</li> <li>- Extensive fan palm forest upstream from the estuarine,</li> <li>- Red mangroves</li> </ul>	<ul style="list-style-type: none"> <li>- Hull River – mud crabs –</li> <li>- Cultural resource</li> <li>- A 1980's and 90's report Peter Stanton by looked at saltwater intrusion. Saltwater pushing up the river itself, killing the melaleucas, or may have a longer history of being dynamic between mangroves and melaleucas</li> <li>- Rainforest on slopes continuous to GBR.</li> <li>- Feral pigs significant threat impacts throughout the Hull Catchment.</li> </ul>
321 – 3 Coastal	<p><b>Slopes:</b></p> <p>Up to 51m</p> <p>Southern end of the hull, headwaters in the low lying areas,</p> <p><b>Landzones:</b></p> <p>Mostly:</p> <ul style="list-style-type: none"> <li>- 3 (alluvium)</li> </ul> <p>Some</p> <ul style="list-style-type: none"> <li>- 2 (coastal dunes) and sand systems</li> </ul> <p>See picture below:</p>	<p>Mostly</p> <ul style="list-style-type: none"> <li>- Alluvium</li> </ul> <p>Some</p> <ul style="list-style-type: none"> <li>- Sand</li> <li>- Mud</li> </ul> <p>White clay base layer</p> <p>Mulgrave Shearzone present here – fault in the past created the Mulgrave valley – can be seen all the way up the coast to Mission Beach</p> <p>More clay holding the wetlands up</p>	<p>2401-2801mm/yr</p>	<ul style="list-style-type: none"> <li>- Deep channels, high banks. Small creeks running into the main channel.</li> <li>- Permanent water</li> <li>- pool riffle system</li> </ul>	<p>groundwater fed</p>	<p>Mostly:</p> <ul style="list-style-type: none"> <li>- Nature conservation</li> </ul> <p>Some:</p> <ul style="list-style-type: none"> <li>- Other minimal use</li> <li>- Small area of residential</li> <li>- Cropping – sugar</li> </ul> <p>A patch of bananas in there before the estuarine area.</p>		<ul style="list-style-type: none"> <li>- Red Mangroves present</li> <li>- Mangrove creek right up to the back of the bananas.</li> <li>- Creeks with some riparian</li> </ul>	<ul style="list-style-type: none"> <li>- Lots of breeding habitat</li> <li>- Connected system to the reef for fish movement but not as much water in terms of freshwater.</li> <li>- Catadromous fish present.</li> <li>- Lots of wetlands in this area.</li> </ul>	

**Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)**

Reach name, polygon number	Natural terrain		Natural hydrological			Modifications		Sediment and water quality issues	Riverine vegetation condition	Other
	Land surrounding channels – slopes, soil, erosion type	Geology and significant natural features	High rainfall and hydrological features	Channel (width, depth, slips)	SW-GW, recharge areas	Land use	Weirs, dams, infrastructure			
										
316 North Hull River O'Donnell Creek Webb Creek Martin Creek Bovril Creek Stony Creek Limbo Creek Bunting Creek	<p><b>Slopes</b> Up to 339m at the Tam O'Shanters Range, Mount Tam O'Shanter 106m.</p> <p><b>Land Zones</b> Mostly</p> <ul style="list-style-type: none"> <li>- 3 (alluvium) main channel</li> <li>- 1 (Tidal flats and beaches)</li> <li>- 11 (Hills and lowlands on metamorphic rocks)</li> </ul> <p>Some</p> <ul style="list-style-type: none"> <li>- 12 (Hills and lowlands on Granite rocks)</li> </ul> <p>Higher elevation metamorphics to the west - Then alluvial areas behind Mission Beach with wetlands present behind granite.</p> <p>Gentle topography</p> <p>Small catchment area</p> <p>underneath Wongaling beach have sand ridges</p>	<p>The areas consists of:</p> <ul style="list-style-type: none"> <li>- Alluvium</li> <li>- Mudrock</li> <li>- Granite</li> <li>- Sand</li> </ul> <p>Small patch of:</p> <ul style="list-style-type: none"> <li>- Arenite-mudrock</li> </ul> <p>Geology effecting wetlands – sandy areas - more clay areas will hold wetlands up and white clays with red mud on top (holds the water for months).</p> <p>Water hits the sand and goes to the north.</p> <p>Basalt at top end - basalt pushed up from the beach and drainage line goes to the west.</p>	<p>2401 – 3201mm/yr</p> <p>Rainfall is lightly lower than in Tully</p>	<ul style="list-style-type: none"> <li>- fast runoff</li> <li>- Channel sits on shearzone (old fault)</li> <li>- Lots of little ox bows – unconfined system.</li> <li>- Lots of meanders.</li> <li>- Channel not particularly deep and meanders – pool ripple. Permanent.</li> <li>- Low energy system – estuarine</li> <li>- <u>Southern end</u></li> <li>- Heads off to the west and runs off the into the drainage area</li> <li>- Sandy area at the top</li> </ul>	<ul style="list-style-type: none"> <li>- Springs in cane area near property in granite with big granite boulders.</li> </ul>	<p><u>Upper</u></p> <ul style="list-style-type: none"> <li>- Nature conservation = 88.56%</li> </ul> <p><u>Lower</u></p> <ul style="list-style-type: none"> <li>- Other minimal use = 4.12%</li> <li>- Grazing native vegetation=3.09%</li> <li>- Residential = 1.55%</li> </ul>	<ul style="list-style-type: none"> <li>- Small dam/reservoir</li> <li>- urban development has altered some of the connections</li> <li>- Sewered except for Bingil Bay which is in the Lower Johnstone.</li> </ul>		<ul style="list-style-type: none"> <li>- Upstream have really extensive fan palm forests.</li> <li>- Mangroves on edge of creek, fan palms above and areas of Melaleuca viridiflora wetlands</li> </ul>	<ul style="list-style-type: none"> <li>- Freshwater until it splits and becomes estuarine</li> </ul>
305 Wongaling Creek Wylies Creek	<p><b>Slopes</b> Up to 395m Clump Mountain at the headwaters of Wylies Creek. Other peaks at 116m, 57m, and 112m.</p> <p><b>Land Zones</b> Mostly</p> <ul style="list-style-type: none"> <li>- 3 (alluvium) main channel</li> <li>- 12 (Hills and lowlands on Granite rocks)</li> <li>- 8 (Basalt plains and hills)</li> </ul> <p>Some</p> <ul style="list-style-type: none"> <li>- 2 (Coastal dunes)</li> <li>- 1 (Tidal flats and beaches)</li> </ul>	<p>The areas consists of:</p> <ul style="list-style-type: none"> <li>- Granite</li> <li>- Sand</li> <li>- Basalt (at the top)</li> <li>- Alluvium</li> </ul> <p>Wongaling Beach – sand ridges all the way up.</p> <p>Wongaling Creek is the boundary for basalts.</p>	<p>2401 – 4001mm/yr</p> <p>Wetlands sit behind the sand dunes at Wongaling Beach.</p>	<ul style="list-style-type: none"> <li>- Fast run off into south mission beach from north mission beach.</li> </ul>		<ul style="list-style-type: none"> <li>- Other minimal use (residual native cover) = 34.51%</li> <li>- Residential= 18.63%</li> <li>- Nature conservation = 26.12%</li> <li>- Grazing native vegetation = 10.81%</li> <li>- Land in transition =2.23%</li> </ul>	<ul style="list-style-type: none"> <li>- Sewage systems accept in Bingal Bay.</li> <li>- Urban development has changed the drainage lines in the south.</li> </ul>			

Sub catchment/ Area Summaries for the Lower Tully (notes for workshop Nov/Dec 2016)

						<ul style="list-style-type: none"><li>- Intensive services = 2.16%</li></ul>				
--	---	--	--	--	--	--	--	--	--	--