

**ANGFA (Qld) General Meeting, Brisbane, 11/02/11**



**Fish migration barriers: Impacts and mitigation for Brisbane waterways**

Ross Kapitzke Environmental Engineer

alaman Fishways

JAMES COOK UNIVERSITY

**Aims of my talk**





- » Discuss freshwater fish migration in waterways
- » Identify fish migration barriers at waterway structures
- » Outline mitigation measures – fish passage
- » Illustrate for Brisbane waterways
- » Demonstrate culvert fishway – Enoggera Creek

11/02/11 Fish migration barriers and mitigation\_ANGFA meeting, Brisbane Feb 2011\_ross.kapitzke@jcu.edu.au 2

alaman

**Freshwater fish values**

*Freshwater fish spend all or part of their life cycle in freshwater environments*

<b>Commercial fisheries</b>	<b>Recreational fishing</b>
 Mullet	 Australian bass
<b>Conservation &amp; biodiversity</b>	<b>Traditional/cultural values</b>
 Gudgeon	 Long finned eel

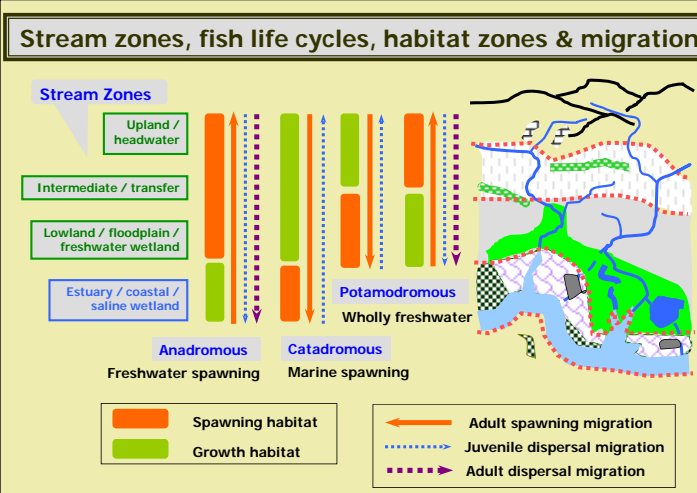
**Migration requirements for freshwater fish**

- » Life cycle stages - Spawning and growth dispersal
- » Recolonising habitats in response to flood or drought
- » Compensation for downstream drift
- » Gene flow through evolutionary-scale movement

11/02/11 Fish migration barriers and mitigation\_ANGFA meeting, Brisbane Feb 2011\_ross.kapitzke@jcu.edu.au 3

alaman

**Stream zones, fish life cycles, habitat zones & migration**



**Stream Zones**

- Upland / headwater
- Intermediate / transfer
- Lowland / floodplain / freshwater wetland
- Estuary / coastal / saline wetland

**Life Cycle Types**

- Anadromous:** Freshwater spawning
- Catadromous:** Marine spawning

**Habitat Zones**

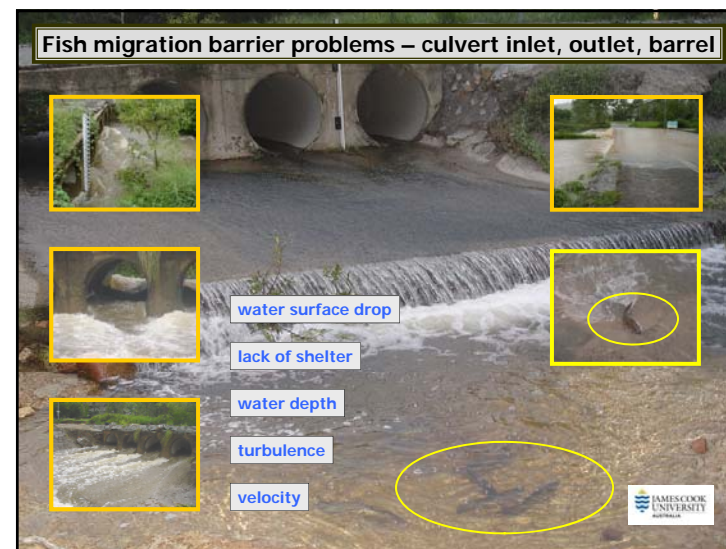
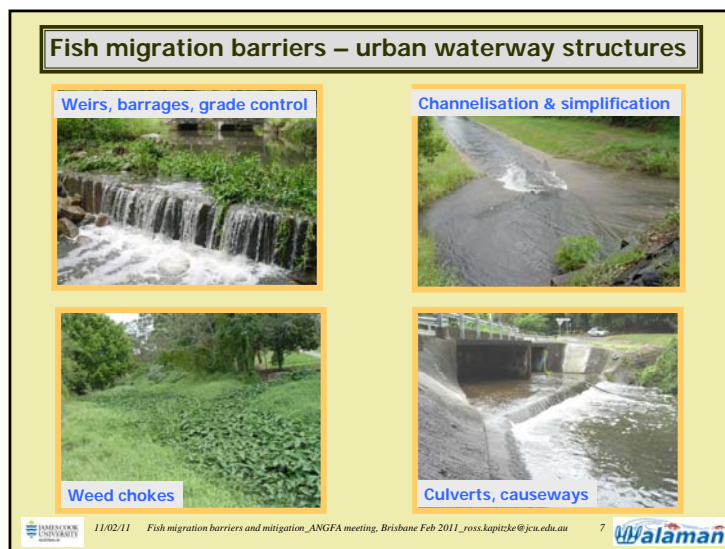
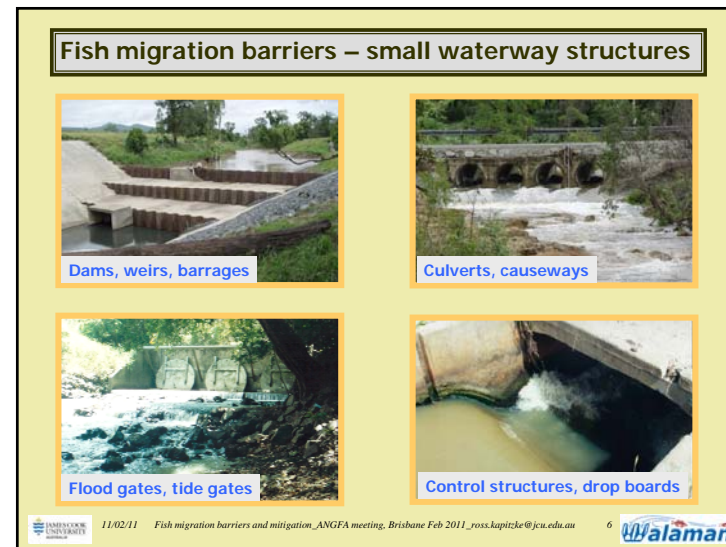
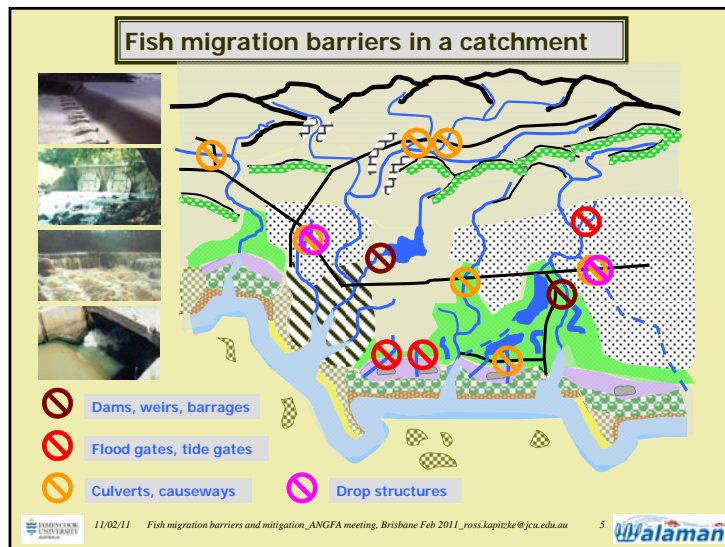
- Potamodromous
- Wholly freshwater

**Legend:**

- Orange box: Spawning habitat
- Green box: Growth habitat
- Solid orange arrow: Adult spawning migration
- Dotted orange arrow: Juvenile dispersal migration
- Dotted green arrow: Adult dispersal migration

11/02/11 Fish migration barriers and mitigation\_ANGFA meeting, Brisbane Feb 2011\_ross.kapitzke@jcu.edu.au 4

alaman

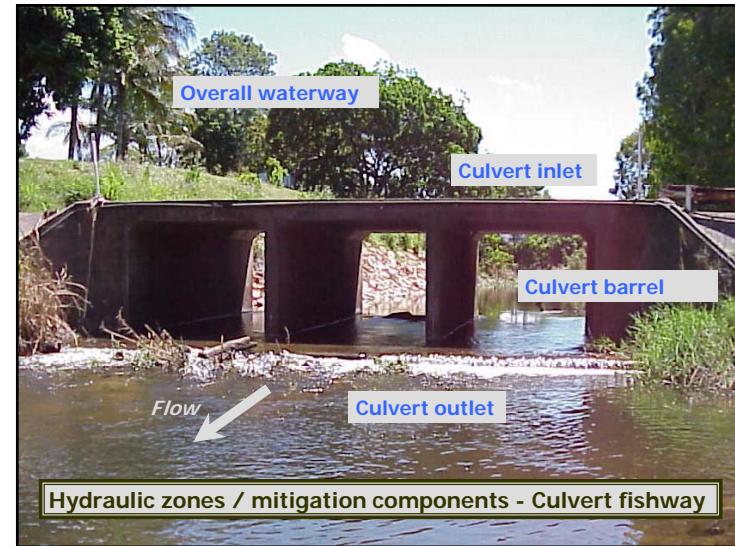


## Movie 1 – Fish migration barrier Solander Road crossing



11/02/11 Fish migration barriers and mitigation ANGFA meeting, Brisbane Feb 2011\_ross.kapitzke@jcu.edu.au

9



## Fish passage mitigation measures for road-waterway crossings

Overall waterway



Arch culvert



Bridge

Culvert inlet, outlet & downstream



Rock ramp



Block Ramp



Apron baffles

Culvert barrel



Stream simulation



Plain culvert



Baffles



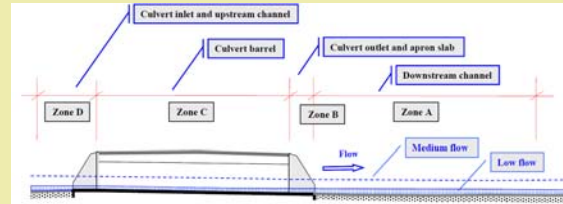
11/02/11 Fish migration barriers and mitigation ANGFA meeting, Brisbane Feb 2011\_ross.kapitzke@jcu.edu.au

11



## Typical hydraulic barriers at waterway crossing zones

Source: Kapitzke 2010, Culvert Fishway Planning and Design Guidelines



	Zone D	Zone C	Zone B	Zone A
High velocity	✓	✓	✓	✓
Flow depth	✓	✓	✓	✓
No shelter	✓	✓	✓	✓
Turbulence	✓	✓	✓	✓
Water drop	✓	✓	✓	✓



11/02/11 Fish migration barriers and mitigation ANGFA meeting, Brisbane Feb 2011\_ross.kapitzke@jcu.edu.au

12







### Fishway component types for culverts and open channels

After: Kapitzke 2010, Culvert Fishway Planning and Design Guidelines



#### Baffle fishways for box culverts

- » Offset baffle fishway
- » Corner "EL" baffle fishway



#### Baffle fishways for pipe culverts


- » Offset baffle fishway
- » Corner "Quad" baffle fishway

#### Ramp fishways for drops / channels

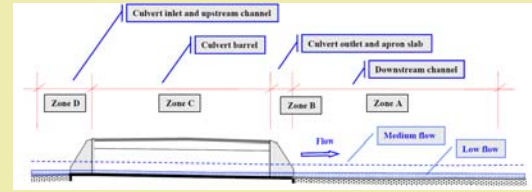
- » Rock ramp / cascade fishway
- » Block ramp fishway


11/02/11 Fish migration barriers and mitigation ANGFA meeting, Brisbane Feb 2011\_ross.kapitzke@jcu.edu.au 13 

### Application of fishway components in hydraulic zones

After: Kapitzke 2010, Culvert Fishway Planning and Design Guidelines




	Zone D	Zone C	Zone B	Zone A
Offset baffle - box	✓	✓	✓	
Corner "EL" baffle	✓	✓	✓	
Offset baffle - pipe		✓		
Corner "Quad" baffle		✓		
Rock ramp / cascade	✓			✓
Block ramp	✓		✓	✓


11/02/11 Fish migration barriers and mitigation ANGFA meeting, Brisbane Feb 2011\_ross.kapitzke@jcu.edu.au 14 

### Prototype fishway design, development and testing


James Cook University, University Creek, Townsville, north Queensland, Australia




Prototype #1 Discovery Drive offset baffle fishway




Prototype #2 Douglas Arterial Project rock ramp fishway




Prototype #3 Solander Road pipe culvert fishway



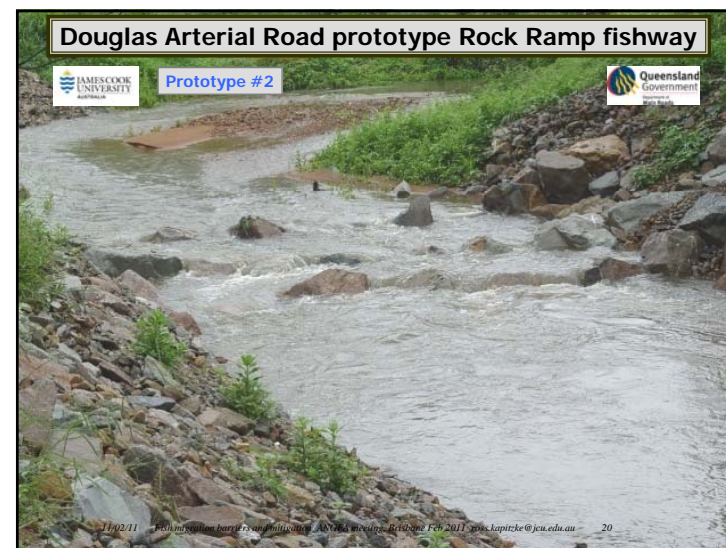
Prototype #4 Discovery Drive corner baffle fishway

11/02/11 Fish migration barriers and mitigation ANGFA meeting, Brisbane Feb 2011\_ross.kapitzke@jcu.edu.au 15 

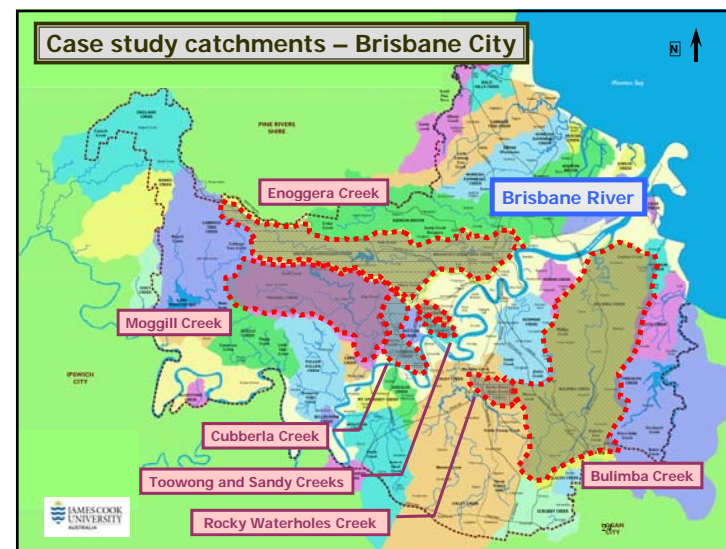
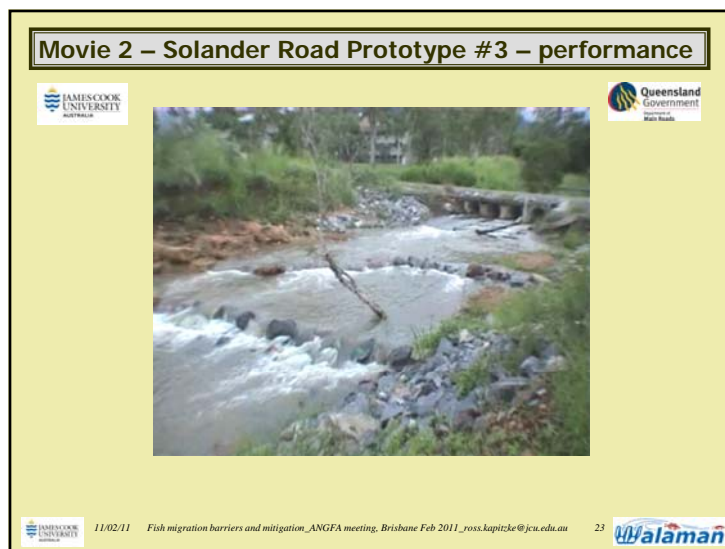
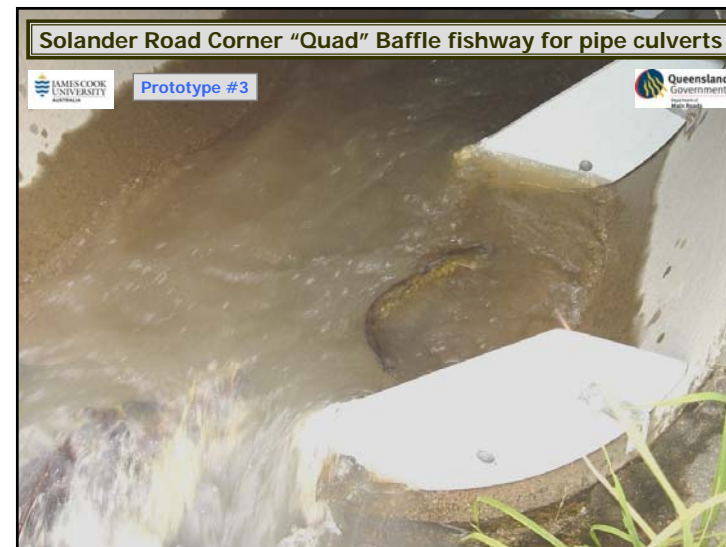
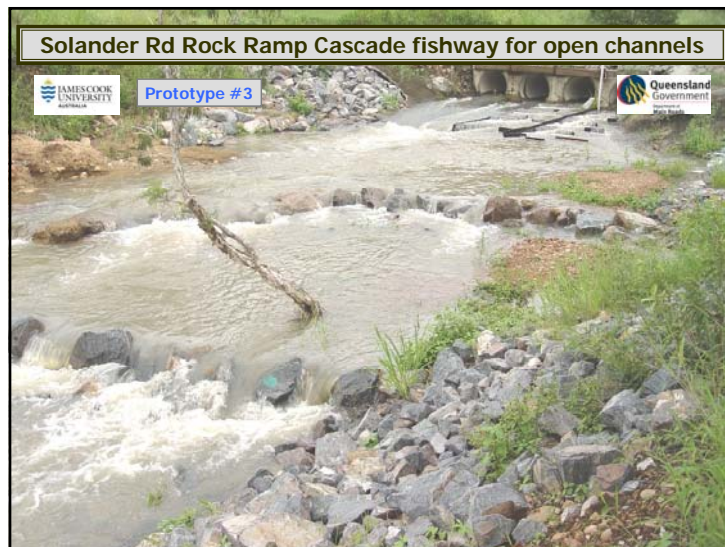
### University Ck fish community – 13 native species observed in 2003



- Long-finned eel
- Black catfish
- Agassiz's glassfish
- Spangled perch
- Hyrtl's tandan
- Barred Grunter
- Empire gudgeon
- Purple spotted gudgeon
- Eastern rainbowfish







## Freshwater fish community – Brisbane Creek catchments

### Native freshwater species

- Brisbane creek catchments – 18 species  
..eels (2), spangled perch, sea mullet, catfish  
..gudgeon (7), rainbowfish, smelt, blue eye  
..glass perch (2), goby, hardyhead (2)
- Moggill Creek – 17 species
- Cubberla Creek – 6 species
- Toowong / Sandy Creeks – 5 species
- Enoggera Creek – 9 species
- Bulimba Creek – 13 species

### Exotic species

- ..Gambusia, Platy, Swordtails, Guppy
- ..Tilapia, Carp, Goldfish



## Potential Waterway barriers – Brisbane Creek catchments

- Moggill Creek – >30 culverts, ?? grade control, ?? other
- Cubberla Creek – 10 culverts, 2 grade control, 3 other
- Enoggera Creek – >10 culverts, >3 grade control, ?? other
- Bulimba Creek – >30 culverts, >3 grade control, ?? Other
- Oxley / RWH Creeks – ?? culverts, ?? grade control, ?? other

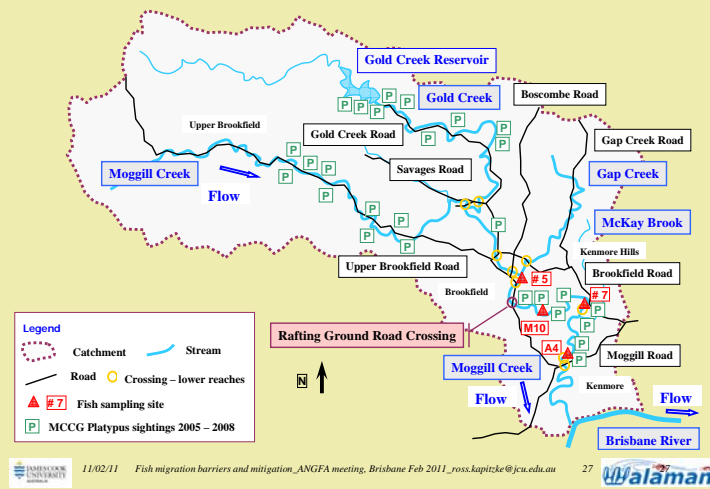
### Road culverts, causeways



### Grade control, channelisation



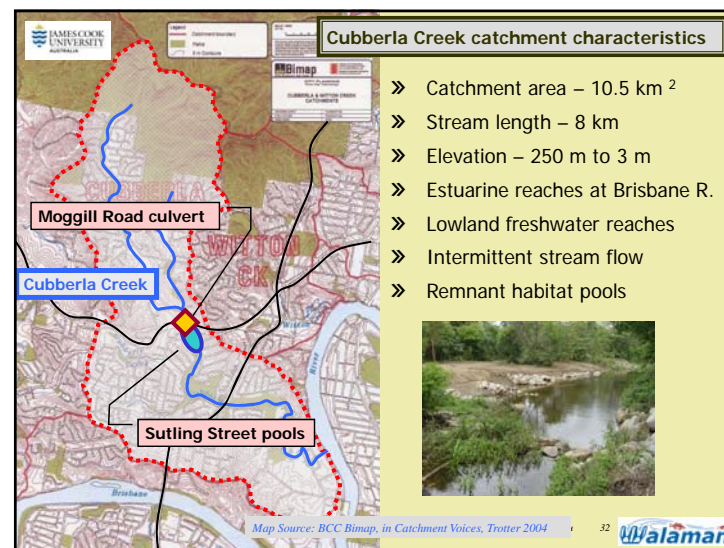
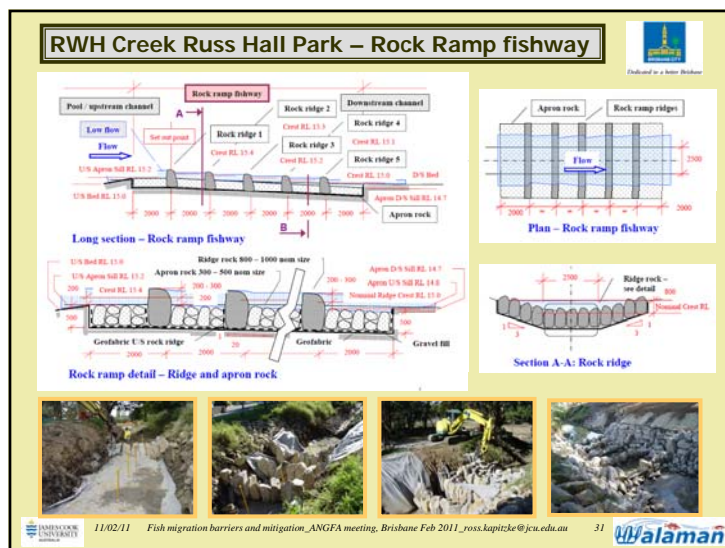
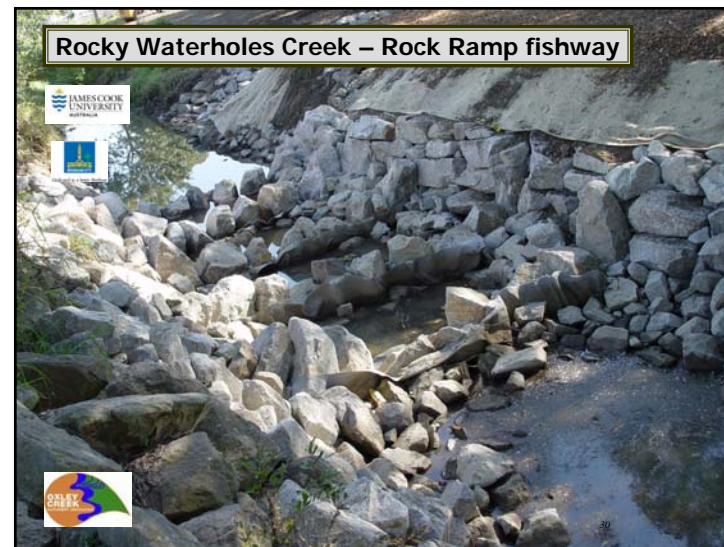
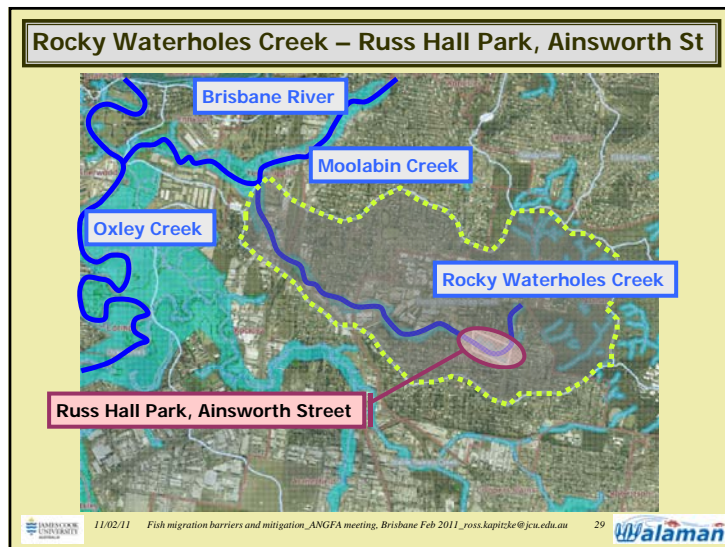
## Moggill Creek catchment aquatic habitat & waterway barriers



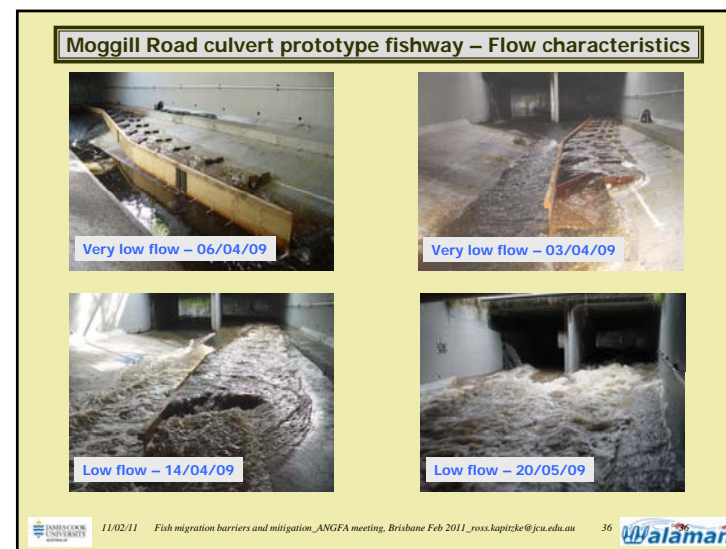
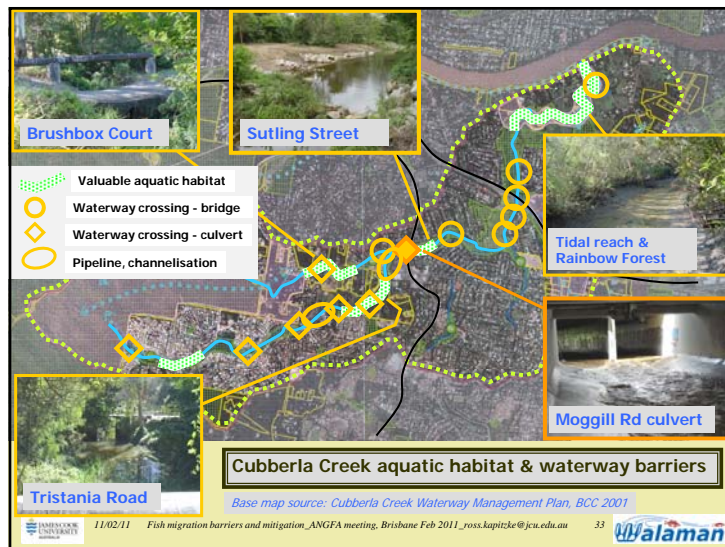
## Moggill Creek Branton Street – Causeway barrier

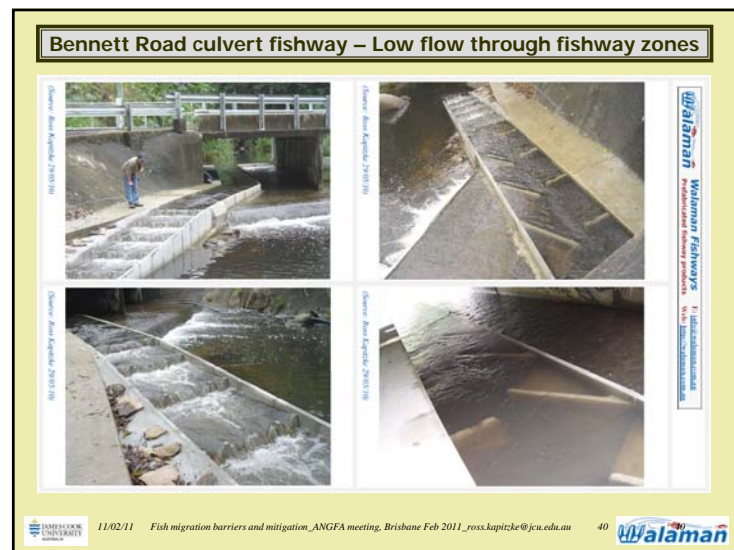
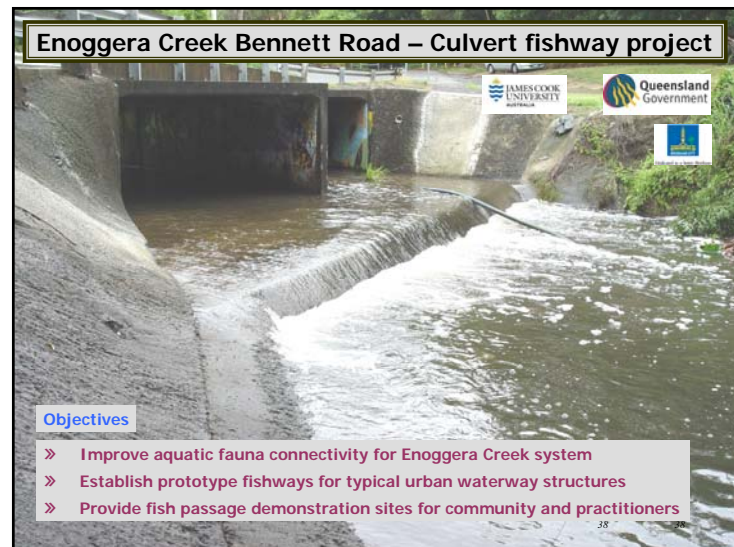
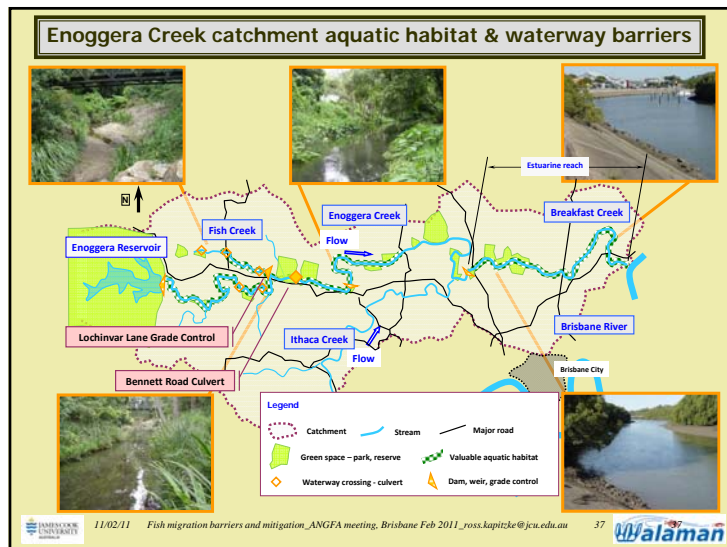














### Bennett Road culvert fishway – Hydraulic monitoring

Observer: Ross Kapitzke 11/02/11

Observer: Ross Kapitzke 22/01/11

Observer: Ross Kapitzke 22/01/11

Observer: Ross Kapitzke 22/01/11

11/02/11 Fish migration barriers and mitigation ANGFA meeting, Brisbane Feb 2011\_ross.kapitzke@jcu.edu.au 41

### Bennett Road culvert fishway – Biological monitoring

Observer: Ross Kapitzke 16/01/11

Observer: Ross Kapitzke 16/01/11

Observer: Ross Kapitzke 16/01/11

Observer: Ross Kapitzke 16/01/11

11/02/11 Fish migration barriers and mitigation ANGFA meeting, Brisbane Feb 2011\_ross.kapitzke@jcu.edu.au 42

### Enoggera Creek Bennett Rd fishway – Fish passage Jan 2011

Bony bream

Gudgeon

Australian smelt

Rainbowfish

11/02/11 Fish migration barriers and mitigation ANGFA meeting, Brisbane Feb 2011\_ross.kapitzke@jcu.edu.au 43

### Movie 3 – Enoggera Ck Bennett Rd fishway – Fish passage

Fish passage success for Walaman Fishways

11/02/11 Fish migration barriers and mitigation ANGFA meeting, Brisbane Feb 2011\_ross.kapitzke@jcu.edu.au 44

