CIVL3140 CATCHMENT HYDRAULICS
FIELD TRIP ON WEDNESDAY 5 SEPTEMBER 2007

When ?

Wednesday 5 September 2007
Departure from UQ St Lucia, College Rd 11:00am
Return at St Lucia campus before 17:00

What to see ?

Storm waterway systems (Q_{des} ~ 220 m^3/s) along Norman Creek
Gold Creek dam, end of Gold Creek Road, Brookfield, Brisbane

What to bring ?
Sturdy clothes and shoes
Hat, sunglasses and sun screen.
Insect repellent
Pens, Paper, Camera.

Safety Officer
Paul PEZZOPANE Mob. Ph.: **04129 54163**

The purpose of the visit is to introduce undergraduate students to existing real-world problems and hydraulic structures : e.g., culverts, spillway systems. The students will be confronted to prototype situations (i.e. full-scale) and they will be able to compare these with laboratory models (e.g. culvert experiment). The visit will show also practical details which must be considered during design stages: e.g., rest area and pedestrian access to a dam, access road to a dam, low-flow channel and access to a culvert. All the structures to be visited are located in the Brisbane area.

The site visit is organised as part of the subject CIVL3140. The visit is scheduled on Wednesday 5 September 2007 (1/2 day). Two sites will be visited :

- Two storm waterway systems along Norman Creek
- Gold Creek dam and its heritage stepped spillway, Brookfield

The students will be asked to write a short report on the visit.

During the first visit, we will walk through two Minimum Energy Loss waterways and look at the characteristics features of a minimum energy culvert : inlet, outlet and barrel. The waterways are located along Norman Creek. At the Gold Creek dam site (end of Gold Creek Rd, Brookfield), we will walk on the dam crest first. A brief history of the dam will be presented. Then we will inspect the existing spillway. A brief history of the spillway will be discussed. The students will be asked to sketch the present spillway and its broad-crested weir.

The bus (Brisbane Bus Line) will depart from College Road (near the intersection with Staff House Road and the lakes) at 11:00 am. We will return before 17:00.

It is recommended to wear strong clothes (shorts or pants) and solid shoes. Hat, sunglasses and sun screen are advised. Warning : at the Gold Creek dam, only a male toilet was available (although not in good condition) at the last visit.

Each student must be equipped with pens and pencils, papers and a battery-operated calculator. The site visit report will be due on Wednesday 5 September 2007 at the return of the field trip (i.e. before 5:00 pm). No report will be accepted after the deadline. The site visit and the companion report are worth 8% of the subject CIVL3140 Catchment hydraulics.

Safety

+ Do not walk into a culvert during flood periods. Do not attempt to drive/ride on Gold Creek road during a flood period.

+ During the visit, be aware of and very-careful with cars, bicycles and vehicles. When exiting from the bus, watch for the traffic.

+ **Good common sense is recommended to avoid any injury** : e.g., do not jump from walls, watch your steps.

+ It is strongly advised to wear adequate shoes or boots. Strong clothing is recommended, incl. shorts and trousers. Dress and skirts are not advised.

+ Hat, sunglasses and sun screen are strongly advised.

+ **Switch OFF mobile phones**. They are a source of distraction. They should only be used in emergency

CIVL3140 CATCHMENT HYDRAULICS
MINIMUM ENERGY LOSS CULVERTS AND WATERWAYS
{HTTP://WWW.UQ.EDU.AU/~E2HCHANS/MEL_CULV.HTML}

Minimum Energy Loss culverts and waterways

A culvert is a covered channel of relatively short length designed to pass water through an embankment (e.g. highway, railroad, dam). In the coastal plains of Queensland (North-East of Australia), torrential rains during the wet season place a heavy demand on culverts. Professors G.R. McKAY and C.J. APELT developed and patented the design procedure of minimum energy loss waterways.

A Minimum Energy Loss culvert or waterway is a structure designed with the concept of minimum head loss. The flow in the approach channel is contracted through a streamlined inlet into the barrel where the channel width is minimum, and than it is expanded in a streamlined outlet before being finally released into the downstream natural channel. Both the inlet and outlet must be streamlined to avoid significant form losses. The barrel invert is often lowered to increase the discharge capacity. The basic concepts of MEL culvert design are : (1) streamlining and (2) critical flow conditions throughout all the waterway (inlet, barrel, outlet) (APELT 1983, CHANSON 2007).

The concept of Minimum Energy Loss culverts was developed by Norman COTTMAN, shire engineer in Victoria (Australia) and by Professor Gordon McKAY, University of Queensland (Brisbane, Australia) during the late 1960s (CHANSON 2003). While a number of small-size structures were designed and built in Victoria, some major structures were designed, tested and built in South-East Queensland. The largest Minimum Energy Loss waterway is the Nudgee Road MEL waterway near the Brisbane airport with a design discharge capacity of 800 m^3/s. Built between 1968 and 1970, the waterway design tested in laboratory with a 1:48 scale model. Since completion, the structure passed successfully floods and it is still in use. An unusual construction feature is the grass-lined channel bed.

References

APELT, C.J. (1983). "Hydraulics of Minimum Energy Culverts and Bridge Waterways." Australian Civil Engrg Trans., I.E.Aust., Vol. CE25, No. 2, pp. 89-95 (ISSN 0819-0259). {http://www.uq.edu.au/~e2hchans/civ3140.html#Bibliography}

APELT, C.J. (1994). "The Minimum Energy Loss Culvert." Videocassette VHS colour, Dept. of Civil Eng., University of Queensland, Australia, 18 minutes.

CHANSON, H. (2006). "Minimum Specific Energy and Critical Flow Conditions in Open Channels." Journal of Irrigation and Drainage Engineering., ASCE, Vol. 132, No. 5, pp. 498-502 (ISSN 0733-9437). {http://espace.library.uq.edu.au/view.php?pid=UQ:7830}

CHANSON, H. (2007). "Hydraulic Performances of Minimum Energy Loss Culverts in Australia." Journal of Performances of Constructed Facilities, ASCE, Vol. 21, No. 4, pp. 264-272 (ISSN 0887-3828). {http://espace.library.uq.edu.au/view.php?pid=UQ:84668}

CIVL3140 CATCHMENT HYDRAULICS
GOLD CREEK DAM AND ITS SPILLWAY
{HTTP://WWW.UQ.EDU.AU/~E2HCHANS/GOLD_CRK.HTML}

Gold Creek dam
Embankment dam (Construction 1882-1885, H = 26 m, L = 187 m)
Second 'large dam' in Queensland
Water supply reservoir for Brisbane

Flood events
1887 : large floods (Jan. 1887: water level less than 1 m below dam crest)
1890 : large floods and damage to unlined rock spillway
1931 : Feb. 1887: water level less than 0.12 m below dam crest
1974

Refurbishments
1887 : **spillway** crest widening (40 → 55 m)
1890 : concrete stepped **spillway**
1904-06 : new (present) outlet tower to replace failed cast-iron tower
1920 : 1.2 m high concrete wall construction on **spillway** crest, dismantled in 1932
1975 : **spillway** crest lowering
1998 : **spillway** crest lowering and dam wall strengthening
2004-06 : **spillway** crest lowering

References

CHANSON, H., and WHITMORE, R.L. (1998). "Gold Creek Dam and its Unusual Waste Waterway (1890-1997) : Design, Operation, Maintenance." *Can. Jl of Civil Eng.*, Vol. 25, No. 4, Aug., pp. 755-768 & Front Cover (ISSN 0315-1468). {http://eprint.uq.edu.au/archive/00002596/}

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COSSINS, G. (2000). "The Gold Creek Dam Story." *Inst. of Engineers, Australia*, Queensland Div., Brisbane, Australia, 227 pages + Appendices.