

RURAL FIRE HYDRANT SYSTEMS

Fire and Security Consulting Services (FSCS) is frequently requested to prepare Alternative Solutions for fire hydrant systems required to protect buildings in rural areas.

BCA and Australian Standard Requirements

The BCA requirement for fire hydrant systems is found in BCA Section E1.3 as reproduced below.

E1.3 Fire hydrants

- (a) *A fire hydrant system must be provided to serve a building-*
 - (i) *having a total floor area greater than 500 m²; and*
 - (ii) *where a fire brigade is available to attend a building fire.*
- (b) *The fire hydrant system-*
 - (i) *must be installed in accordance with AS 2419.1; and*
 - (ii) *where internal fire hydrants are provided, they must serve only the storey on which they are located except that a sole-occupancy unit -*
 - (A) *in a Class 2 or 3 building or Class 4 part may be served by a single fire hydrant located at the level of egress from that sole-occupancy unit; or*
 - (B) *of not more than 2 storeys in a Class 5, 6, 7, 8 or 9 building may be served by a single fire hydrant located at the level of egress from that sole-occupancy unit provided the fire hydrant can provide coverage to the whole of the sole-occupancy unit; and*

The technical requirements for such systems are contained in AS2419.1 and, in summary require:-

1. Connection to a reticulated municipal water supply providing specified flow and pressure. Generally the flow requirements are 10l/s for buildings with a floor area (under roof) of between 500m² and 999m², and 20l/s for buildings of 1,000m² up to 10,000m². The pressure requirements are 350kPa for external hydrants and 700kPa for internal hydrants.
2. Where the reticulated water supply has sufficient flow but insufficient pressure, AS2419.1 requires the installation of a single booster pump, usually a compression ignition (diesel) engine driven pump.
3. Where the reticulated water supply has insufficient flow, AS2419.1 requires on site storage of 4 hours water supply and two pumps, one of which must be a compression ignition (diesel) engine driven pump.
4. Fire hydrants located externally such that all parts of the building are within reach of a 10m water stream from a 60m hose; or
5. Fire hydrants located internally within fire isolated exits such that all parts of each floor are within reach of a 10m water stream from a 30m hose.

Rural Area Issues

Many buildings in rural areas are within the coverage area of an Urban, Auxiliary or Rural Fire Brigade and therefore the requirements of BCA E1.3 (a) (ii), i.e., “a fire brigade is able to attend a building fire”. However in many cases the local reticulated water supply does not extend out to these rural areas.

This issue then imposes a requirement for the owner of a rural property to install on site water storage and two fire hydrant pumps. For smaller buildings between 500m² and 999m² this equates to water storage (in two tanks) of 144,000 litres and for buildings over 1,000m², 288,000 litres.

The majority of rural area buildings that FSCS is asked to address are small produce storage, packing, machinery storage or livestock sheds of BCA Class 7 or 8 and of Type C construction and located at significant distances from property boundaries or residences on the property. In most cases the construction is of lightweight steel frame with sheet steel walls and roofs.

I have costed compliant fire hydrant installations for several Clients and the cost is usually in excess of the replacement cost of the building which it is required to protect.

Performance Based Alternative Solution

Whilst FSCS is familiar with the QFES Policy on Fire Engineered Alternative Solutions which require a two stage approach of , Fire Engineering Brief (FEB) and Fire Engineering Report (FER), FSCS is also sympathetic to the procedural costs of this process which adds to the cost of the resultant solution.

The purpose of this document is to present a preliminary case for consideration by QFRS and the Certifier to consider waiving the need for certain rural projects to have a FEB.

In consideration of this waiver, FSCS presents below a generic Brief covering the various issues.

DtS Requirements

A fire hydrant system is required to meet BCA Section E1.3.

- EP1.3** *A fire hydrant system must be provided to the degree necessary to facilitate the needs of the fire brigade appropriate to-*
- (a) fire-fighting operations; and*
 - (b) the floor area of the building; and*
 - (c) the fire hazard.*

Non Compliance

This Brief considers the reduction of the on site water supply to one hour and the deletion of the requirement for two on site pumps.

Acceptance Criteria

The acceptance criteria is that compared to a DtS design, the Fire Brigade should have an equal or better opportunity to facilitate their activities for both rescue and fire fighting in line with the objectives of the BCA.

Assessment Methodology

This assessment is examined and judged against BCA DtS and / or Performance Requirements using Assessment Methods as described in Section A0.9 of the BCA.

- (a) complying with the *Deemed to Satisfy Provisions*; or
- (b) formulating an *Alternative Solution* which:
 - (i) complies with the *Performance Requirements*
 - (ii) *is shown to be at least equivalent to the Deemed to Satisfy Provisions*; or
- (c) a combination of (a) and (b); or
- (d) *Expert Judgement*.

Assessment

General

This assessment will demonstrate that the provision of an on site one hour water supply and a hydrant system without installed fire pumps which relies on the fire pump on the Fire Brigade appliance meet the BCA Performance Requirements EP1.3

"to the degree necessary to facilitate the needs of the fire brigade appropriate to-(a) fire-fighting operations; and (b) the floor area of the building; and(c)the fire hazard".

Proposed Strategy

Fire Hydrant System

Considering the economic and technical difficulties in providing a compliant system, the following strategy is considered to provide an acceptable level of fire fighting capability whilst meeting the requirements of AS2419.1 and QFRS operational procedures.

For this rural property there is no reticulated municipal water supply and accordingly AS2419.1 would require an on site storage capacity of 144,000 litres with two pumps for buildings with a floor area (under roof) of between 500m² and 999m², 288,000 litres for buildings of 1,000m² up to 10,000m².

This Brief proposes to make a 1 hour water supply available and install a twin head hydrant(s) connected to an underground 100mm fire main as necessary to provide coverage to the building(s) using external hydrants. It is proposed that a tank suction and delivery point into the underground main be provided such that the attending QFRS or Rural Fire Brigade appliance can connect to the suction point and deliver water at the requisite flow and pressure to the hydrant. Water supply to the tanks may be from the roof stormwater collection, on site bore or purchased from a water supplier. There will be a requirement that the tank(s) have a capacity of 110% of the calculated 1 hour duration of the flow specified in AS2419.1 and maintained at not less than 90% capacity at all times.

Considering the quantity of water

The first element of the assessment discusses the quantity of water to effectively fight the fire. This is a 'Qualitative' analysis based on expert judgement and addresses the likely fire sizes and the extinguishing capacity afforded by the hydrant system performance.

AS2419.1 requires the on site fire water storage to be for 4 hours at the design flow rate of 10 or 20 litres per second dependant on the building area. This equates to 144,000 litres or 288,000 litres respectively.

Considering the following:-

1. For a building without a fire detection system, alerting the fire Brigade becomes a matter of chance. When the building is occupied the occupants are likely to alert the Fire Brigade promptly by telephone. However when unoccupied this alert will be delayed considerably and will be subject to chance observations by passers-by. This is especially relevant for rural buildings as they are remote from potential passers-by. In the event of a fire, the property occupants, if on site and nearby, may alert the Fire Brigade within minutes, certainly there will be no monitored detection system.
2. Fire Brigade response and attendance is likely to be delayed. If served by an Urban Station, the rural property is likely to be a significant distance from town and travel time may be up to 30 minutes. If served by an Auxiliary Brigade or Rural Brigade, the paging of fire fighters and their response could equally be 30 minutes or more.
3. With a time frame of 40 minutes or more from the onset of fire to the point where fire fighters arrive and prepare (BA procedures etc.) for search and rescue and even if

unlimited water supply were available, the quantity of water will have no bearing on search and rescue activities beyond the use of small bore appliance mounted hose to protect entry. Ultimately the fire will have developed to a stage beyond the point where successful live rescue of anyone within the fire scene can be effected.

4. With a time frame of 40 minutes or more from the onset of fire to the point where fire fighters commence fire fighting operations, it is likely that flashover will have occurred and Type C construction buildings will have largely been destroyed. Thereafter, fire fighters will be likely be concentrating on prevention of excessive fire spread to adjoining areas.

Accordingly the proposed water capacity of one hour duration is considered sufficient for fire scene entry protection and subsequent clean up and is considered to be sufficient "to the degree necessary".

Considering the deletion of pumps

The second element of the assessment is a 'Qualitative' analysis to demonstrate the effect of Fire Brigade operations on the deletion of the required pumps and utilises a 'timeline' of events commencing with the arrival of the attending Brigade appliance and officers. This 'timeline' analyses the standard QFRS tactics for the appliance to set up for boosting the hydrants from the appliance pump and then commence an initial fire attack with a single high pressure small bore hose and nozzle.

It is considered that because of the frequent use and maintenance that the fire pump on the appliance will have a significantly greater degree of reliability than an on site pump.

As discussed in this Report, AS2419.1 requires that the water supply be arranged so that during maintenance at least 50% of the volume remains available for use. The background to this requirement is that when a tank is being cleaned it is normally required to be emptied.

Note that AS1851 Table 4.4.3 Item 3.13 requires "(c) Drain, inspect, clean as necessary and refill the water tank every 10 years" but that Item 3.13 (a) allows a diver to carry out such an inspection. It is considered that there is no difference between the intent of items (a) for the 5 year procedure and (c) for the 10 year procedure except for the word "refill".

It is considered mandatory to schedule the tank cleaning to be conducted by a contractor with the capability to vacuum the tank floor without the necessity to empty the tank below 50% capacity.

It is understood that in the event of a fire call the standard QFRS response would be to dispatch a single appliance manned by an Officer and two or three fire fighters. This may vary and is highly dependant on response from the available fire fighters if an Auxiliary or Rural Brigade is to respond.

On arrival, it is understood that after an initial visual assessment as to the necessity of any rescue activity, the standard procedure would be for the appliance to be connected to the Booster.

If in "working hours" and rescue activities are required, rescue will be attempted before any fire fighting takes place simultaneously with the attending appliance being readied for boosting from the appliance pump. During this time, as previously discussed, the appliance mounted small bore hose is likely to be deployed by the fire fighters to protect their fire scene entry.

If no rescue is required and the Officer decides to implement an immediate fire attack, it is understood that entry into a fire compartment would not normally be effected until the boosting facility is connected.

Accordingly it can be demonstrated that irrespective of the provision of on site pump(s), fire fighters will always use the appliance pump and therefore the on site pump(s) can be considered redundant.

Provision of a Single Tank

AS2419.1 requires that the water supply be arranged so that during maintenance at least 50% of the volume remains available for use. The background to this requirement is that when a tank is being cleaned it is normally required to be emptied. This means that the usual arrangement is the provision of two tanks each containing 50% of the required water.

It is most likely that rural owners would elect to install multiple prefabricated tanks instead of a single large tank.

However if an owner elects to install a single tank, FSCS considers that this would be acceptable because AS1851, the Australian Standard on Maintenance, Table 4.4.3 Point 3.13 requires, in the maintenance procedure, “(c) *Drain, inspect, clean as necessary and refill the water tank every 10 years*”. Point 3.13 (a) allows a diver to carry out such an inspection. It is considered that there is no difference between the intent of items (a) for the 5 year maintenance procedure and (c) for the 10 year procedure except for the word “refill”. Therefore AS1851 does not require the provision of multiple tanks.

Conclusion

This fire safety analysis concludes that:

Considering Water Capacity

- A 1 hour water capacity is sufficient for the time required to fight the fire.
- Even if fire suppression is not contemplated and efforts are concentrated on saving the portion of the building not involved by preventing fire spread, the water supply is sufficient to outlast the estimated burn-out time of the compartment involved.
- A single tank meets the maintenance requirements of AS1851.

Considering Fire Fighting Operations

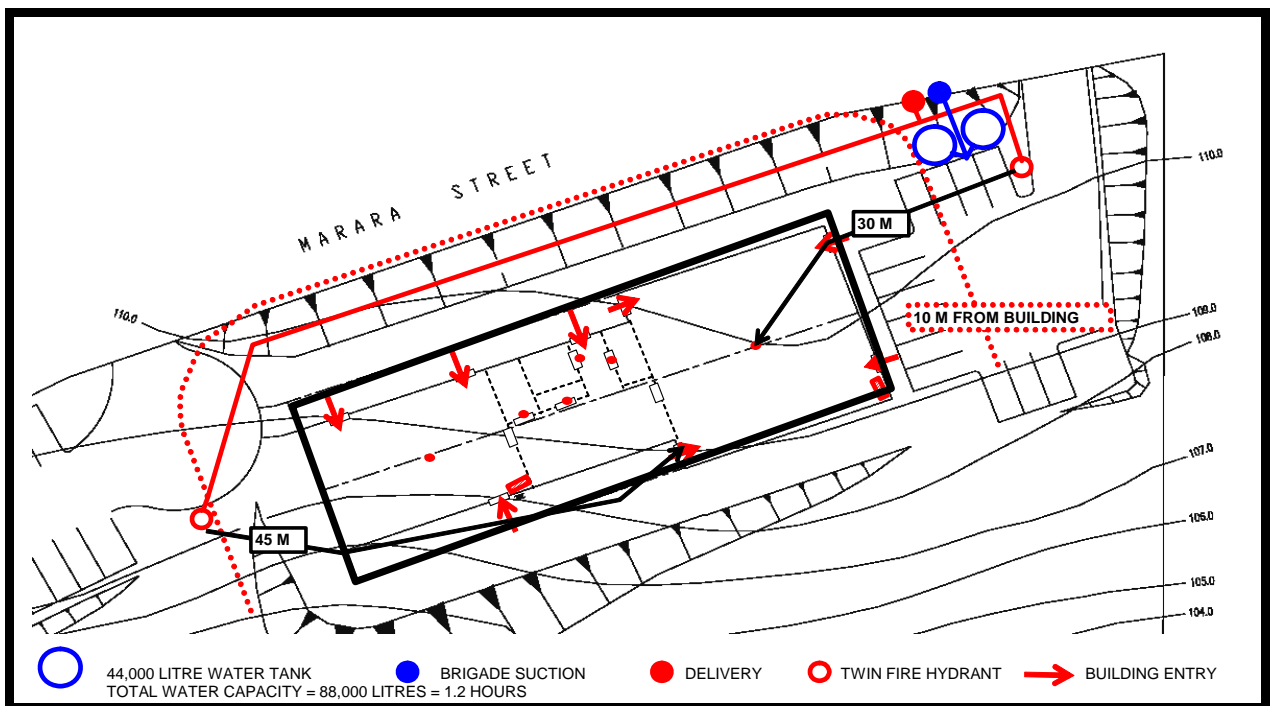
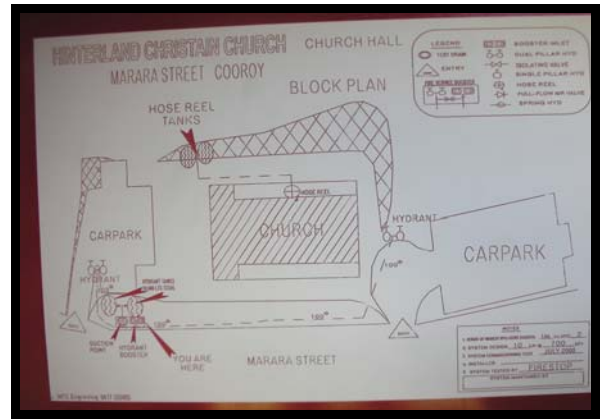
- Simultaneous with fire scene assessment, pump connection to and delivery from the fire appliance will be established enabling the use of the on site water storage.
- The attending appliance has water storage capacity for immediate fire fighting.
- In view of the above, it is considered that the time required for appliance connections will only add a small time margin to preparing for fire attack as compared with having an on site pump already running.

Therefore, based on the above, it is considered that the proposed Alternative Solution satisfies Performance Requirement Requirements EP1.3.

Example of a Rural Hydrant System Installed to the Alternative Solution Above

These photographs show the fire hydrant system installed at the Hinterland Christian Centre, which is located in the outskirts of Cooroy and served by an Auxiliary Brigade. The system protects a church assembly hall with a floor area of >1,000m².





Sincerely,

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