

Greater Shepparton City Council

Report on the Congupna Urban
Drainage Strategy

Evidence for Panel Hearing

September 2016

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1. Introduction

I Uwe Paffrath, Principal Civil Engineer with Paffrath Consulting, have been asked by the Greater Shepparton City Council to provide a report for the Amendment C187 Panel. This amendment seeks to apply the Public Acquisition Overlay (PAO22) to part of 25 Congupna West Road, Congupna and part of 226 Old Grahamvale Road, Congupna.

Previously I was also commissioned by the Greater Shepparton City Council to undertake an Urban Drainage Strategy to review the number of site specific and municipal wide drainage strategies. The report presents the proposed stormwater collection, detention, treatment and discharge layout for the Congupna Township catchment. This report identified that the proposed approach minimises the stormwater infrastructure to be maintained and renewed by Council, while providing Congupna with an appropriate level of drainage and stormwater detention and treatment in accordance with the Greater Shepparton City Council requirements.

I acknowledge that I have read the Victorian Civil & Administrative Tribunal Practice Note 2: Expert Evidence and agree to be bound by it.

As a Principal Civil Engineer, I have had wide-ranging practical and project management experience through over 30 years working on rural and urban drainage projects, including condition assessments, contract administration and supervision.

Other experiences include civil engineering design, tender documentation, contract administration and supervision, and I have specific knowledge in Infrastructure Quality procedures, Asset Management planning as well as environmental and maintenance management systems.

Some of the projects that I have worked on ranges from the Provision of services for the investigations and design solutions to a number of drainage issues for both urban and rural sites, including retention basins, pump stations, underground pipelines, open channels and flood mitigation works, development of Storm Water Management Plans, project managed rural drainage schemes and general drainage engineering projects. The range of clients I worked for includes State Departments, Local Government and private clients, and have previously worked in Local Government and I understand the drainage issues within an urban/rural municipality.

2. Brief

I have been asked to report on the following: -

- ▶ analyse the existing drainage conditions and catchment area 2 and confirm the required retardation for varying storm durations;
- ▶ review of the functionality of the existing swale drain and determine the shutdown storage requirements; and
- ▶ consider the three potential drainage solutions prepared by Council titled Congupna Stage 3 Drainage Alignment Evaluation Options 1, 2 & 3, discuss the alternative options and provide a recommendation on the preferred option.

3. Background

3.1 Existing Site

Congupna is a rural village and district on the Goulburn Valley Highway in central north Victoria, 10 km north-east of Shepparton.

Following the flooding event in early March 2012, which was considered to be around a 1% (1 in 100-year ARI) storm event, Council undertook a drainage catchment analysis to determine possible drainage upgrades for immediate and future implementation for the township of Congupna.

In consultation with the Catchment Management Authority, a detailed drainage catchment study was undertaken to determine natural flow paths and rural drainage flows which impact upon Congupna's urban drainage system. This study was vital to ensure that any upgrades to the existing Congupna drainage system cause no adverse flooding to landowners upstream or downstream of the township of Congupna.

3.2 Drainage within the Congupna Urban Area

Council has identified two drainage catchment areas relevant to the Congupna Urban Area, each contributing to a separate drainage outfall. Catchment area 1 consists of the area highlighted as "Congupna Village Subdivision Stage 1", and Catchment area 2 consists of the area highlighted as the "Congupna Village Subdivision Stage 2" (northern half of Wallace Street). The proposed stage 3 drainage upgrade works are to address the drainage issues within the north half of Wallace Street located within the Congupna catchment area 2.

Catchment area 2 consists of approximately 4.3ha of developed residential land located on Wallace Street in Congupna. The residential catchment area comprises of wide grassed/ vegetated swale drains along both sides of the street, directing stormwater flows towards the existing Goulburn-Murray Water (G-MW) drain located on Congupna East Road. Stormwater is discharged via gravity into the G-MW drain through a 225 diameter outfall structure.

Council have indicated that the structure has to be manually opened and closed by the residents, depending on how full the G-MW drain 1/5/11 is flowing. This leads to the nature strips being frequently inundated with water, allowing the breeding mosquitoes and making the nature strips difficult to maintain.

3.3 Preferred Options

Flooding is a natural phenomenon. In urban areas where drainage relies on pipe networks, open channels and creeks, flooding can cause infrastructure damage (both private and public), loss of amenity, environmental degradation and pose safety risks.

The objective of a drainage strategy is to manage the natural storm events in such a way as to reduce the risk of harm to people and property.

3.3.1 Drainage Catchment 1

Council initially indicated its intention to upgrade the council drainage infrastructure that currently outfalls into Goulburn Murray Water drain 1/5/11. Council after reviewing the collected field data proposed an alternate concept drainage option.

It was determined that due to minimal available fall from Congupna to the existing drainage outfall into Goulburn Murray Water drain 1/5/11, the only way to achieve suitable grade and cover for the proposed pipeline would involve the construction of a retardation basin. Council had previously identified the construction of a retardation basin as a possible long term project.

The proposed design solution involved the relocation Congupna's existing drainage outfall from Goulburn Murray Water drain 1/5/11 (existing outfall north of Congupna) to Goulburn Murray Water drain 5/11 (west of Congupna). Goulburn Murray Water provided "in principle approval" for the location of the proposed drainage outfall relocation which would service drainage catchment 1.

3.3.2 Drainage Catchment 2

Drainage catchment 2 currently discharges via gravity into Goulburn Murray Water drain 1/5/11.

As a part of the proposed Congupna flood mitigation works, it is proposed that drainage from Drainage Catchment 2 would outfall via a new outfall pipeline following a new alignment (to the East of Congupna). The drainage upgrade will require the construction of a new retardation basin which would then discharge into Goulburn Murray Water drain 1/5/11 via a new pump station.

The planned site of the new retardation basin for Drainage Catchment 2 is on the north east corner of property 226 Old Grahamvale Road, Congupna (currently privately owned land).

This land is zoned Farming 1 and affected by the Land Subject to Inundation Overlay. The proposed use is best defined under the Greater Shepparton Planning Scheme as a 'Minor Utility Installation', being land used for a utility installation comprising stormwater or flood water drains or retarding basins. A planning permit is not required to use or develop land for a Minor Utility Installation in the Farming Zone 1 or Land Subject to Inundation Overlay.

4. Drainage Design

The capacity of the drainage networks is based on design principles using catchment area, coefficient of runoff, and rainfall intensities. The rainfall intensities vary according to the size of storm events.

Pipes or waterways have known capacities based on the size and grade of the pipe or waterway and therefore calculations can be made to determine which storm event frequencies can be contained within the network.

Rainfall events are random and vary in duration and intensity, so for design purposes a statistical estimate of the period in years between the occurrences of the rainfall event determines the rainfall intensity used. This is called the Average Recurrence Interval (ARI). That is a 1 in 5-year rainfall event is an event that is statistically likely to occur once in 5 years. This can also be expressed as the percentage likelihood of rainfall event occurrence in one year. This is called the Annual Exceedance Probability (AEP). For example, a 20 per cent likelihood of a rainfall event occurring in one year is the same as a 1 in 5-year rainfall event.

For residential allotments the current Council standards (Infrastructure Design Manual) require, as a minimum, a pipe network that contains a storm event up to a rainfall intensity equivalent to a 1 in 5-year ARI and for the whole network to achieve a 1 in 100 years ARI through the pipe network and overland flows.

4.1 Design Considerations

Effective stormwater systems must be able to adequately manage small, minor and major storm events. They can be designed to do this by considering the management objectives of each design event and the scale at which the solution (usually a single or series of best management practices) is to apply.

Runoff from the whole catchment generated by the 5-year ARI event should be managed within landscaped areas in road reserves, public open space or linear multiple use corridors.

During major storm events (in excess of 5-year and up to 100-year), structural controls, roads, public open space and natural waterways and wetlands may all be inundated to varying levels. Flows from 100-year events will use the retention and detention capacities of 5-year sized systems before they flow into 100-year sized systems. This will reduce the detention volume required in 100-year sized systems.

Flow calculations for the total drainage system must take into account the different flow paths taken by the minor and major systems, any overflows from other drainage systems, and the interaction between minor and major system flows.

Storm water run-off occurs when: -

- The ground or land surfaces becomes saturated and unable to accept the further infiltration or surface storage of rainwater; or

- ▶ The intensity of rainfall exceeds the soil's infiltration rate, even though the ground is not yet saturated.

The factors that affect the volume of storm water run-off include: -

- ▶ The size of the drainage catchment
- ▶ The extent, intensity and duration of rainfall across the catchment
- ▶ The ability of the ground to absorb water, which is influenced by land slope, the depth of soil above rock, the type of rock and the type of vegetation cover
- ▶ The percentage of the land area covered by impervious surfaces (e.g. roads & roofs)
- ▶ Water retention on the lands surface.

The factors that influence the height of flooding at a particular location include: -

- ▶ The peak discharge passing down a drainage system, be it a pipe, channel, road network or watercourse.
- ▶ The hydraulic capacity of the drainage system.
- ▶ The extent of blockages within the floodway, be it from flood debris, fences, structures or fallen trees.

4.2 Basis of Design

The conventional approach to storm water drainage design is to intercept, collect and dispose of storm water as quickly as possible, generally in pipelines and/or lined channels.

As water flowing in piped and lined channels reaches higher velocities than water flowing overland and in natural channels, the time of concentration to points at the downstream end of a catchment is reduced. This reduced time of concentration and the increase in the impervious area that normally accompanies development, leads to increased peak discharges in areas downstream of developed areas.

Increases in peak discharge can in turn result in increased downstream flooding and/or in the scouring of natural watercourses. Scoured material is later deposited in rivers and estuaries, causing siltation.

Because of the problems associated with drainage systems that reduce the time of concentration, there has been a significant change in the approach to storm water drainage design in recent years.

Where possible, measures are taken to ensure that the peak discharge is unaltered by development. This is generally achieved at the land use planning stage by providing for the incorporation of retention basins in drainage systems and by making use of natural drainage features wherever possible. Floodways are also provided to ensure that damage resulting from storms of greater intensity than that of the design storm is minimised.

Existing land use zonings in the older developed areas of Greater Shepparton rarely provide adequate open space in suitable locations and so limit the scope for application of modern techniques in storm water drainage management. In these areas there is no alternative to the construction of conventional drainage systems designed to dispose of peak discharges in the most efficient way possible.

However, even in older developed areas, floodways should be progressively provided as land is redeveloped and consideration should be given to the construction of retention basins wherever possible. Suitable areas for the location of retention basins include playing fields, golf courses and open space reserves.

The capacity of the drainage networks is based on design principles using catchment area, coefficient of runoff, and rainfall intensities. The rainfall intensities vary according to the size of storm events.

Pipes or waterways have known capacities based on the size and grade of the pipe or waterway and therefore calculations can be made to determine which storm event frequencies can be contained within the network.

To design a whole pipe network to take a major storm (1 in 100-year ARI) event would require very large pipe and pit systems and is therefore financially prohibitive. There was a period of time over the past 10 years where the state wide Planning Scheme has permitted a standard where a 1 in 2-year ARI rainfall event has been accepted as the storm event to be carried by the pipe network in new subdivisions.

The proposed Congupna drainage works has been designed to meet the current objectives of Council's Infrastructure Design Manual (IDM). The primary objectives of the IDM are to: -

- ▶ ensure that minimum design criteria are met in regard to the design and construction of Infrastructure within the municipalities regardless of whether it is constructed by Council or a Developer, and
- ▶ recognise and deal with the various issues currently impacting on the land development industry, in particular sustainability, integrated water cycle management, timeliness and affordability.

For residential allotments the current IDM standards require, as a minimum, a pipe network that contains a storm event up to a rainfall intensity equivalent to a 1 in 5-year ARI and for the whole network to achieve a 1 in 100-year ARI through the pipe network and overland flows.

The Council's current approach to the pressures of infill or higher density housing redevelopment is to require (as part of a planning permit) on site retention of the 1 in 100-year rainfall event with the discharge restricted to the capacity of the existing drainage system, taking into consideration the location of the redevelopment within the catchment. Water Sensitive Urban Design is also required to improve the quality of water discharging into the outfall drainage system and natural waterways.

Council has determined that: -

- ▶ to reduce inundation of public areas within the Congupna Township, the proposed drainage outfall pipeline infrastructure shall be designed for a 1 in 10-year ARI event,
- ▶ the proposed residential drainage infrastructure shall be designed for a 1 in 5-year ARI event, and
- ▶ for the whole network to accommodate a 1 in 100-year ARI capacity through offsite flood storage facility.

4.3 Overlays

An overlay is a map in a council planning scheme showing the location and extent of special features, such as where land may be subject to flooding.

Their key purpose is to: -

- ▶ minimise the effects of overland flows and flooding on new buildings
- ▶ ensure new developments do not adversely affect existing properties

Overlays are based on the extent of flooding resulting from a 1 in 100-year storm. This relates to a storm event of such intensity, based on historical rainfall data, which has a one per cent chance of occurring in any given year.

Having this information means drainage issues can be addressed at the start of the development process and proposals are properly designed.

4.3.1 Land Subject to Inundation Overlays (LSIO)

These are planning scheme controls that apply to land affected by flooding associated with waterways and open drainage systems. Such areas are commonly known as floodplains. These overlays require a planning permit for buildings and works.

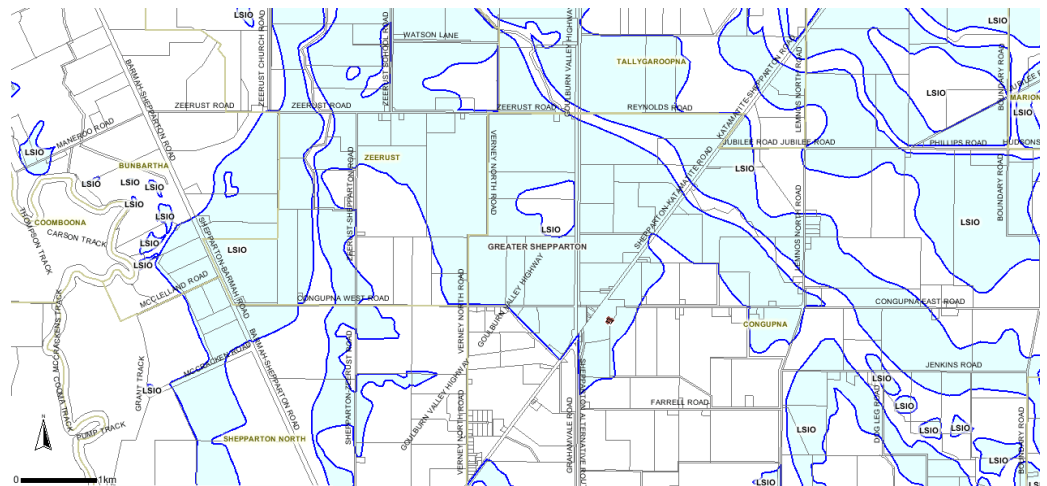
The purpose of the LSIO is to ensure that future developments maintain the free passage and temporary storage of floodwaters, minimise flood damage, are compatible with the flood hazard and local drainage conditions, and will not cause a significant rise in flood level or flow velocity.

Identification of the extent of the flood plain is based on years of scientific, spatial referencing and ground truthing. Unidentified changes can have serious implications for emergency agencies in managing any flood situation, compromise the safety of community members and place community assets at risk. Ultimately any changes to the flood plain seriously reduce our ability to predict where the flood water will flow and its impact during times of emergency.

An overland flow path is an above ground section of the drainage system and generally affects low lying and natural drainage path areas. Overland flows occur when the maximum capacity of the underground piped drains has been reached and the

drainage system can no longer cope with excess run off from heavy rainfall. The excess run off then travels along the overland flow paths.

Figure 1 Land Subject to Inundation Overlay Map



4.3.2 Purpose

To implement the State Planning Policy Framework and the Local Planning Policy Framework, including the Municipal Strategic Statement and local planning policies.

To identify land in a flood storage or flood fringe area affected by the 1 in 100-year flood or any other area determined by the floodplain management authority.

To ensure that development maintains the free passage and temporary storage of floodwaters, minimises flood damage, is compatible with the flood hazard and local drainage conditions and will not cause any significant rise in flood level or flow velocity.

- ▶ maintains the free passage and temporary storage of floodwater;
- ▶ minimises flood damage;
- ▶ is compatible with flood hazards, local drainage conditions and the minimisation of soil erosion, sedimentation and silting.

4.4 Catchment 2

4.4.1 Drainage Catchment Area Analysis

Catchment area 2, consisting of low density residential areas and Wallace Street road reserve, commencing from Lot 9 on the eastern side and Lot 14 on the western side of Wallace Street is approximately 4.3ha.

The detailed catchment analysis is summarised below: -

- ▶ Low density Residential Area – 3.8ha (IDM 100yr ARI Runoff Coefficient ≈ 0.4)
- ▶ Wallace Street Road Reserve – 0.5ha (IDM 100yr ARI Runoff Coefficient ≈ 0.75)
- ▶ Total Catchment Area – 4.3ha (weighted runoff coefficient ≈ 0.44)

4.4.2 Existing Minor Flow System

Based on detailed design calculations, the peak minor flow will be as follows: -

- ▶ Minor Flow (5yr ARI):
- ▶ Development Catchment Area: 4.3 ha
- ▶ C: 0.44 (Refer Congupna Urban Drainage Strategy Appendix D)
- ▶ $I_{20,5}$: 47.6 mm/hr
- ▶ $Q_5 = 0.250 \text{ m}^3/\text{sec}$

4.4.3 Existing Major Flow System

Based on detailed design calculations, the peak major flow of the existing catchment area will be as follows: -

- ▶ Major Flow (100yr ARI):
- ▶ Area: 4.3 ha
- ▶ C: 0.44 (Refer Congupna Urban Drainage Strategy Appendix D)
- ▶ $I_{20,100}$: 89.3 mm/hr
- ▶ $Q_{100} = 0.47 \text{ m}^3/\text{sec}$

4.5 Confirmation of Adopted Design

The current IDM requires the whole drainage network to cater for a 1 in 100-year ARI storm event through the combined pipe network and overland flows. With this being a brownfield site, it is acknowledged that the design does not deal with the 1 in 100-year ARI due to overland flow (no regional catchment analysis undertaken to date) being affected by existing crossing roads, drains, rail reserve and having water backing up from G-MW drains. During a 1 in 100-year ARI event, stormwater will be retained within the swale and road networks temporarily during the peak of the storm until the underground pipe network has capacity to deliver the stormwater to the retention basin where there is design capacity for the 1 in 100-year ARI event.

To upsize the proposed drainage pipes from a 1 in 10-year to a 1 in 100-year ARI will double the costs, hence it is an acceptable design solution to allow the time taken for the draining of the site to increase and utilise the road reserve to temporarily store the stormwater run-off.

With this land being subject to inundation, the site may be affected by other catchments within the floodplain and structures located in the path of local overland flow could cause the water to be redirected or deflected to other adjoining properties. Such impacts have to be mitigated in the design of proposed developments.

Council has investigated and put forward designs that have taken into consideration the extent of the floodwater and the location of structures within the flood paths which can alter the flow regime to the detriment of adjoining properties. Structures in the path of overland flow would cause the water to be redirected or deflected to other

adjoining properties. The flood water could also cause “afflux” (a rise in water level) upstream of the structure.

The proposed stormwater collection, detention, treatment and discharge layout for the Congupna Township catchment satisfies the integrated site based stormwater management plan obligations for the site. The proposed approach minimises the stormwater infrastructure to be maintained and renewed by Council while providing Congupna with an appropriate level of drainage and stormwater detention and treatment in accordance with the IDM and Greater Shepparton City Council requirements.

5. Existing Swale Drains

Existing drainage infrastructure within Wallace Street currently consists of wide grassed/vegetated swale drains along both sides of the street. From desktop studies it has been assumed that the north half of Wallace Street (Congupna Village Subdivision Stage 2) directs storm water flows towards the existing G-MW drain located on Congupna East Road and the southern half of Wallace Street (Congupna Village Subdivision Stage 1) directs flows towards Old Grahamvale Road.

A standard swale has been assumed for the purpose of preparing indicative storage volumes with the following characteristics: -

- ▶ Top of bank width 5m
- ▶ Swale base width 1m
- ▶ Maximum depth 600mm
- ▶ Cross-sectional area $\approx 1.8\text{m}^2$

Indicative calculations suggest that the swale drains within Wallace Street offer the following storm water retardation properties: -

- ▶ Congupna Village Subdivision Stage 2 (North half of Wallace Street)
 - Total swale length – 500m (approximately)
 - Effective Swale Length (length subject to inundation) – 50% due driveways, build-up of sediments etc.
 - Estimated swale capacity – 450m^3 (approximately)
- ▶ Congupna Village Subdivision Stage 1 (South half of Wallace Street)
 - Total swale length – 750m (approximately)
 - Effective Swale Length (length subject to inundation) – 50% due driveways, build-up of sediments etc.
 - Estimated swale capacity – 675m^3 (approximately)

The above values are indicative only for the purpose of discussion. The values and estimates are subject to detailed investigation including site inspection, feature survey and detailed design.

Therefore, the total estimated storage available within the swale drains in both Congupna Village Stage 1 and Stage 2 equals approximately $1,125\text{m}^3$.

Based on the above volumes for the Congupna Village Subdivision Stage 2, the swale drain does not meet either the 1 in 5 nor the 1 in 100-year shut down storage capacity, being approximately 37% and 20% of the required volumes respectively.

6. Drainage Alignment Evaluation of Council Options

6.1 Option 1 (Adopted Option)

Drainage Upgrade Works Option 1, refer plan titled Congupna Stage 3 Drainage Alignment Evaluation – Option 1

- ▶ Is in accordance with the Congupna Drainage Strategy
- ▶ Option 1 has been fully investigated and designed and meets the objectives of the Infrastructure Design Manual
- ▶ Maintain Wallace Street swale drain arrangement.
- ▶ Installation of approximately 70m of 450mm dia. RCP to relieve swale drain flows. Pipe sized and graded to cater for 100-year flows.
- ▶ Construction of a storm water retardation basin with appropriate capacity to cater for a 100-year storm event assuming blocked outfall conditions.
- ▶ WSUD systems included with the basin floor to provide adequate treatment prior to discharging into the G-MW drain.
- ▶ Installation of a new pump station and rising main to discharge storm water into the existing G-MW drain at the allowable rate.
- ▶ Basin located at an adequate distance from residential areas to accord with EPA guidelines.

6.1.1 Benefits:

- ▶ Proposed drainage system maintains the existing drainage characteristics of the Wallace Street catchment area including natural overland flow paths.
- ▶ Separates catchment areas and provides adequate retardation capacities for individual catchments reducing the risk of flooding issues.
- ▶ Improves the existing drainage system and ensures adequate drainage of the existing swale drains fronting the residential properties. Reduces the impact of inundation and retention of storm water within swale drains.
- ▶ Minimal impact on any existing drainage infrastructure and residential areas.
- ▶ Construction of an additional retardation basin with potential to utilise for any future development within the nearby area.
- ▶ Major (1%) flows will be efficiently directed to the proposed retention basin via existing overland flow paths and underground drains without requiring significant modification to existing nature strips and infrastructure as the retention basin is in close proximity to Catchment 2.

6.2 Council Option 2

Drainage Upgrade Works Option 2, refer plan titled Congupna Stage 3 Drainage Alignment Evaluation – Option 2

- ▶ Reshaping and profiling of existing swale drains through the length of Wallace Street to direct all storm water towards Old Grahamvale Road. Includes the modification and replacement of approximately 25 occupation culverts and 2 road culverts to suit revised swale levels.
- ▶ Supply and installation of approximately 70m of additional drainage infrastructure along Old Grahamvale Road to service Wallace Street swale drains and discharge into proposed drainage infrastructure undertaken as Congupna Drainage Upgrade Stage 1 works.
- ▶ Upsize of approximately 415m of drainage infrastructure currently proposed as part of the Stage 1 works.
- ▶ Expand proposed Stage 1 retardation basin that is currently designed to cater for Catchment 1 to ensure an adequate capacity to cater for Catchment Area 2 (approximately 2,200m³)

6.2.1 Benefits:

- ▶ Utilises existing / proposed drainage infrastructure and retardation basin undertaken as Stage 1 works.
- ▶ Reduced operating costs associated with the proposed pump station and rising main proposed in Option 1.
- ▶ Removes the requirement of acquiring land behind the properties located at the north eastern end of Wallace Street.

6.2.2 Areas of Concern:

- ▶ Revised drainage arrangements subject to detailed site investigations, feature survey, service location and detailed design services.
- ▶ Potential for major disturbance to nature strips associated with reshaping swale drains to include one way crossfall for the extent of Wallace Street towards Old Grahamvale Road. Ensuring adequate swale grades over this length may result in swale drains becoming quite deep at the Old Grahamvale Road end.
- ▶ Swale drain capacities will need to be increased to cater for 5-year ARI flows for the Wallace Street residential catchment area (10.5ha).
- ▶ Generally, road reserves act as conduits to transport the 100-year ARI flows toward the retention basin, therefore as this option proposes to drain Catchment 2 via Catchment 1, further investigation is required to determine the risk and measures required to mitigate flooding and damage to properties as a result modifying the

major overland flow paths through the catchment 1 and 2 as proposed under this option.

- ▶ Increased catchment area and length of swale drains increases risk of ponding within the swales resulting in maintenance issues, stagnant water and potential seepage into road subgrade materials.
- ▶ Increased costs associated with the upgrade of proposed drainage infrastructure in Stage 1 works.
- ▶ Wallace Street swale drains may be graded against the natural overland flow path.
- ▶ Potential design and construction constraints with existing authority assets as a result of additional drainage infrastructure and increased drainage pipe diameters, subject to detailed investigation.
- ▶ Additional land acquisition as a result of increased basin footprint and capacities.
- ▶ Risks associated with combining the entire Congupna catchment area to one proposed discharge point as a result of potential blockages.

6.3 Council Option 3

Drainage Upgrade Works Option 3, refer plan titled Congupna Stage 3 Drainage Alignment Evaluation – Option 3

- ▶ Maintain Wallace Street swale drain arrangement.
- ▶ Supply and installation of approximately 230m of additional drainage infrastructure along Congupna East Road and Katamatite-Shepparton Road to service Wallace Street swale drains and discharge into proposed drainage infrastructure undertaken as Congupna Drainage Upgrade Stage 2 works.
- ▶ Upsize approximately 260m of drainage infrastructure proposed as part of Stage 2 works.
- ▶ Upsize of approximately 415m of drainage infrastructure proposed as part of Stage 1 works.
- ▶ Expand proposed Stage 1 retardation basin to ensure adequate capacities to cater for Stage 2 catchment area (approx. 2,200m³)

6.3.1 Benefits:

- ▶ Proposed drainage system maintains the existing drainage characteristics of the Wallace Street catchment area including natural overland flow paths and swale drains.
- ▶ Utilises existing / proposed drainage infrastructure and retardation basin proposed within Stage 1 and Stage 2 works.

- ▶ Improves the existing drainage system and ensures adequate drainage of the existing swale drains fronting the residential properties in Wallace Street. Reduces the impact of inundation and retention of storm water within swale drains.
- ▶ Minimal impact on any existing drainage infrastructure and residential areas.
- ▶ Reduced infrastructure costs associated with the proposed pump station and rising main proposed in Option 1.
- ▶ Removes the requirement of acquiring land behind the properties located at the north eastern end of Wallace Street.

6.3.2 Areas of Concern:

- ▶ Revised drainage arrangements subject to detailed site investigations, feature survey, service location and detailed design services.
- ▶ Increased costs associated with the upgrade of proposed drainage infrastructure in Stage 1 and Stage 2 works.
- ▶ Potential design and construction constraints with existing authority assets as a result of additional drainage infrastructure and increased drainage pipe diameters. Subject to detailed investigation.
- ▶ Additional land acquisition as a result of increased basin footprint and capacities.
- ▶ Risks associated with combining entire Congupna catchment area to one proposed discharge point.

6.4 Costings

A general review of the submitted costing has been undertaken and the following comments provided.

It is suggested that all estimates be updated to reflect current market rates, as these rates appear to be based on cost estimates that are in excess of 12 months old.

6.4.1 Option 1:

- ▶ Option 1 costing are based on a thorough investigation and full detailed design.
- ▶ The estimates do not appear to include land acquisition costs and authority fees that may be applicable for works within the VicRoads Road Reserve.

6.4.2 Option 2:

- ▶ These cost estimates are subject to further investigation and design to determine cost associated with the modification of existing authority assets as a result of upsized drainage infrastructure and swale modifications and to fully explore the level of service that can be achieved given the existing site constraints.

- ▶ The estimates do not appear to include consultancy fees, land acquisition costs and authority fees that may be applicable for works within the VicRoads Road Reserve.

6.4.3 Option 3:

- ▶ These cost estimates are subject to further investigation and design to determine cost associated with the modification of existing authority assets as a result of upsized drainage infrastructure and swale modifications and to fully explore the level of service that can be achieved given the existing site constraints.
- ▶ The estimates do not appear to include consultancy fees, land acquisition costs and authority fees that may be applicable for works within the VicRoads Road Reserve.

7. Response to Brief

The proposed Congupna Stage 3 (Option 1) drainage works provides the best most cost effective option as the design has the ability to: -

- ▶ preserve existing valuable elements of the stormwater system, such as natural channels, swales and roadside vegetation,
- ▶ limit changes to the quantity and quality of stormwater at or near the source,
- ▶ use structural measures, such as treatment techniques and a retardation basin, to improve water quality and control streamflow discharges,
- ▶ Mitigation of run-off and peak flows has been demonstrated via modelling for catchment treatments,
- ▶ Minimises risk of flood damage to properties and infrastructure
- ▶ Stormwater quality and detention devices have been located and sized to fit in with the local landscape and topography,
- ▶ The water quality objectives have been achieved by utilising elements of the catchment.
- ▶ Option 1 has been prepared in accordance with the Congupna Drainage Strategy and the IDM and has been fully investigated and designed.
- ▶ Option 1 includes the construction of independent storm water retention basins to manage major storm events for each independent catchment. This ensures that drainage is safely and efficiently managed and directed to the stormwater retention basins without putting pressure of the on the adjacent catchment. This also reduces the risk of the Congupna Township being effected by potential underground drainage blockages as Catchment 2 is serviced by an independent drainage system and overland flow paths.
- ▶ Option 1 is the most cost effective of the three options.
- ▶ Catchment 1 and 2 are managed independently, therefore Catchment 1 will not be affected by major flows generated from Catchment 2.
- ▶ Impacts on existing servicing has been identified and fully costed for Option 1 during the design phase and measures have been put in place to manage these effected assets. Where Options 2 and 3 require the proposed drainage system to be upsized significantly, which would likely increase the risk and cost associated with asset diversions and infrastructure upgrades.
- ▶ The existing swale systems through Catchments 1 and 2 play an important role as they provide local drainage for the street network during a minor event and act as flow path during a major event. However, there is limited capacity within the swale network to retain the 100-year ARI event. Therefore, retentions basin are required in close proximity to the catchment boundary to reduce the risk of property damage and flooding during a 20% or 1% storm event.

- ▶ A full risk analysis and investigation would be required for options 2 and 3 to confirm the extent of works required, costs associated with additional drainage works, swale modification works, impacts on existing services and existing infrastructure and to determine the level of service that can be achieved given existing site constraints. Where option 1 has been fully investigated and designed to meet the IDM.

8. Declaration

I have made all the inquiries that I believe are desirable and appropriate and that no matters of significance which I regard as relevant have to my knowledge been withheld from the Panel.

In the collation of this advice the following sources of information were used: -

- ▶ Congupna Urban Drainage Strategy
- ▶ Greater Shepparton City Council, Consultancy Brief – Congupna Urban Drainage Design (Stage 3)
- ▶ Greater Shepparton City Council, Congupna Stage 3 Drainage Alignment Evaluation Options 1, 2 & 3 (Conceptual Plans)



Uwe Pafrath

Principal Civil Engineer

Appendix A

Qualifications

Uwe Paffrath

Career History

► 2009 to Present: Paffrath Consulting – Principal Civil Engineer

Survey and Design of drainage solutions for an alternate outfall pipeline and retardation basin for the township of Congupna and for the Tallygaroopna urban drainage upgrades – Greater Shepparton City Council

Undertaking the role of Superintendent on behalf of Public Transport Victoria, for construction projects.

Provision of services for the review of detailed design for the reconstruction of major road infrastructure projects (Vaughan Street Redevelopment; Verney Road) – Greater Shepparton City Council

The provision of project and contract management services for the Cairn Curran Reservoir and Lake Eppalock projects – Goulburn-Murray Water.

Provision of services for the investigations and design solutions to a number of drainage issues for both urban and rural sites, including retention basins, pump stations, underground pipelines, open channels and flood mitigation works – Greater Shepparton City Council.

Development of Risk Management Guidelines that set out design information and procedures for the compliance of bus routes and stops for employees of the Public Transport Victoria involved within the Public Transport, Bus and Regional Services Directorate.

Assisting with the development of Project Management Guidelines and reviews of the processes – Greater Shepparton City Council.

Construction surveillance officer for the Euroa-Mansfield / Quarry Road intersection Access Upgrade, Gooram – Rural Works Pty Ltd.

Lectured at Goulburn Ovens Institute of TAFE the following subjects for the Diploma of Engineering Drafting: Geometric Road Design, Applied Engineering Hydrology Principles, Design Underground Piping Drainage Systems and Minor Culverts, and Project Management.

Survey and Design of Railway Station Car Parks – Public Transport Victoria.

Provision of guidance and undertaking of audits for Roadworks Traffic Schemes on the M80 and Tullamarine Freeway construction projects – Leighton Contractors & McConnell Dowell Constructors.

Undertake Traffic Impact Assessments for new developments where it is required to determine traffic volumes from site investigations, client and relevant road authority supplied information, impact of the developments on surrounding intersections and roads and any required traffic management devices, including pedestrian and cyclist infrastructures.

Undertaken a number of Road Safety Audits, Stages 1, 2, 3, 4, 5 & 6 for a number of different clients – State Road Authorities, Design and Construction companies.

Construction Management of the Victoria Park Lake Redevelopment (construction of wetland and reconstruction of lake) – including the review of detailed designs, development and preparation of tender documentations for the construction activities – Greater Shepparton City Council.

Investigate and determination of the road approach radii for the repositioning of a major intersection – Chris Smith & Associates.

Investigate the impact of the altering of a Developments Staging will have on the capacity (Level of Service) of the intersection – Chris Smith & Associates.

Project Management for the rehabilitation works along the Colac-Lavers Hill Road, south of Colac – VicRoads Program Delivery Department, Geelong.

► 2004 to 2009: GHD Shepparton – Senior Civil Engineer

Design & Construction of the Tarago Water Treatment Plant for Melbourne Water – Role is of Team Leader for Site Works, where my responsibilities are to liaise directly with the design and construction teams and establish two-way communication with relevant personnel; provide design/technical support input for the earthwork, roadworks, site drainage, landscaping and security components of the project; ensure design requirements and construction methodology complement each other; assist in developing construction methodology to suit changes in designs; and monitor quality, safety & environmental requirements from both the design & construction side of works.

Deer Park Bypass Projects – as Lead Senior Road Safety Auditor regularly undertake Roadwork Traffic Scheme Audits, site safety reviews and checking of traffic management plans, during the construction of the Bypass.

For VicRoads Program Development Department – identifying the types and causes of crashes by using information from RCIS and other sources, undertake site inspections and other investigations to identify deficiencies or features of the identified intersection or section of road, undertake a road safety review that considers the needs of all road users and prepare a Scope Approval Report.

Conducting assessment of the current status of existing traffic control devices, providing recommendations for any modifications/additions to obtain a balance between providing for traffic and providing for activities that occur beside and across roads.

Project Management for a number of Road Safety Projects from pre-construction activities to contract supervision.

Investigate and determination of the reclassification of existing road network once former section of main road is bypassed by a new Freeway.

Determination of emergency detour routes, for the safe passage of freeway traffic around hazardous sites along the Calder Freeway

Manage the detailed design of major intersections.

Project Management for the construction of Wastewater Reuse projects ranging from 100 ML to 650 ML, including the construction and commissioning of pipelines, pump station and associated works, and the installation of the necessary electrics and controls to transfer treated wastewater from the new winter storage to farmers for pasture irrigation.

To identify, record assets and operational responsibilities on declared roads in accordance with relevant code of practice in the road management bill, for resolution by VicRoads and various municipalities, areas of demarcation on all arterial roads within the municipality.

Conducting assessment of the current status of existing traffic control devices, providing recommendations for any modifications/additions to obtain a balance between providing for traffic and providing for activities that occur beside and across roads.

Investigate the impact of the impending closure of the Yarrawonga Weir Bridge on traffic movements between Yarrawonga and Mulwala. This project required the undertaking of traffic surveys, with use of the results to estimate future traffic demands, and the investigation of future crossing options for the Murray River, providing assessment of positive benefits and impacts of the proposed options.

Responsible for the project management / contract administration of major civil engineering projects.

Undertake Traffic Impact Assessments for new developments where it is required to determine traffic volumes from client and relevant road authority supplied information, impact of the developments on surrounding intersections and roads and any required traffic management devices, including pedestrian and cyclist infrastructures

Development of Traffic Management Plans and undertaking of Road Safety Audits.

► 1999 to 2004: Earth Tech Engineering Shepparton – Project Manager Infrastructure

Responsible for design, supervision and contract administration of major civil engineering projects in both NSW and Victoria, which include multi-lot residential subdivisions and structural works.

Development of Stormwater Management Plans, Engineering Development Manuals, Pedestrian / Cyclist Access Mobility Plans.

Project Management for design and construction of pavements, drainage structures, water resource and wastewater treatments.

Project Management for the survey and design of fibre optic installations within southern NSW.

Development of Quality Systems for civil contractors including the preparation of quality, occupational health & safety, environmental, site safety and traffic management plans.

Preparation of detailed designs, tender documentations and environmental management plans/statements.

Conducting audits on Contractor's quality, safety and environmental management plans and field activities.

The development of asset management strategies, conducting asset classifications and condition assessments, including the utilisation of CAD and GIS.

Qualified Senior Road Safety Auditor and has undertaken a number of safety strategy assessments which include heavy vehicle, pedestrian and cycle management plans.

Development and preparation of Contractor's environmental management induction program for Alpine construction activities.

Managed environmental impact studies which included planning, community consultation, workshops, liaison with utility services and authorities, design reporting and presentation, project evaluation, asset risk management and optimisation of asset lives, long-term strategy development, and business planning.

Examinations of existing and investigations into future over sized /extra mass vehicle routes.

Community consultation into strategic bicycle route selection and development of solutions to areas of conflict between traffic and cyclists.

► 1994 to 1999: Greater Shepparton City Council – Project Manager Construction & Assets

Project managed the design, planning, community consultation, workshops, liaison with utility services and authorities, development of tender documentation and contract specifications, contract administration and supervision for rural drainage schemes.

Development of a strategy for the management of Council owned transport assets.

Development of an Infrastructure quality Procedures and Asset Management Manual.

Implementation of a new cross-functional Capital Works Budget so as to minimise the review process and to maximise its tractability within departments.

Implementation of a maintenance management system and ensure its use is maximised by both the Council and its maintenance contractor.

Project managed all construction and annual supply projects as allocated, including \$1.1 Million resealing contract.

Improving techniques for measuring the impact of trade-offs between maintenance and replacement, including critical analysis and risk management.

Managing the demand for asset through better utilisation, risk management, alternatives to asset use and more accurate service demand forecasting.

► 1994 to 1994: Shire of Rodney Shepparton – Works Engineer (10 months)

Manage all construction and bituminous works, special projects (construction of recreational facilities, landscaping, swimming pools) and other civil works.

To lead and supervise contractors and operations group personnel.

To administer the Works Program including preparation of written and statistical reports, submissions and correspondence ensuring that information, advice and recommendations are provided to senior offices in a timely manner.

Liaise with service authorities.

► 1985 to 1994: Shire of Rodney Shepparton – Engineer

Carry out surveys, undertake design and prepare plans and specifications for civil works programmed by Council and the Rodney Water Board.

Responsible for the implementation of Traffic Calming designs.

To initiate “Black Spot” intersection treatments.

Management of swimming pools (policy development, maintenance, operational, risk & health procedures)

Undertake field surveys and prepare layout plans for landscaping and general parks and garden works.

Prepare cost estimates and assist with budget control.

Check structural computations for building approvals and Council building projects, undertake site structural assessments/supervision and provide technical advice to the building department.

Assist and relieve during periods of annual leave the Planning Officer with technical matters relating to planning applications as required.

Qualifications and Affiliations

- ▶ Bachelor of Engineering (Civil)
- ▶ Senior Road Safety Auditor (Accredited – VicRoads)
- ▶ Internal Auditor (Quality Assurance)
- ▶ Mine Manager – Trenches
- ▶ Industry Induction in OHS (NSW White Card & Victorian Red Card)
- ▶ Aquatic Facility Operators Certificate – Technical & Human Resources

Appendix B

Congupna Stage 3 Drainage

Options 1 to 3 – Alignment and Cost Estimates



Congupna Urban Drainage Upgrade - Option 1 (Council preferred option)

	Estimated construction cost	
Congupna Stage 1	\$	596,395.00
Congupna Stage 2	\$	206,195.00
Congupna Stage 3	\$	295,306.75
Total exl GST (no contingency)	\$	1,097,896.75
If completed as one Stage		
Total exl GST (no contingency)	\$	1,060,896.75

CONGUPNA STAGE 1 - OPTION 1

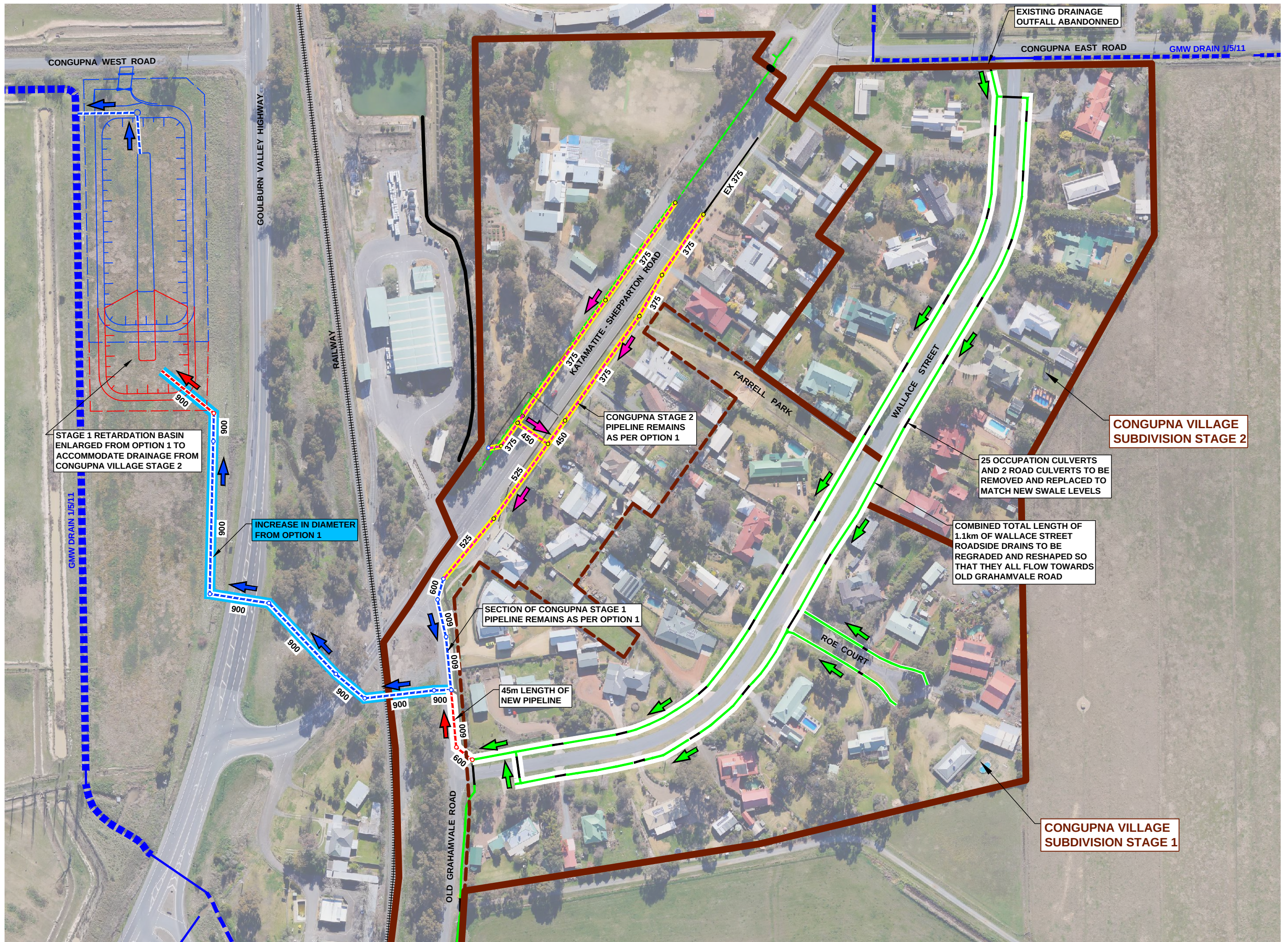
Item No.	Description of Work	Estimated Quantity	Unit	Rate \$	Extended Amount \$ (GST Excl.)
1.0	GENERAL				
1.1	Site establishment, permits, and insurances.	1	Item	\$5,000.00	\$5,000.00
1.2	Site management: preparation of a Management Plan including site management, environmental management and OH&S systems where required.	1	Item	\$20,000.00	\$20,000.00
1.3	Traffic Management	1	Item	\$1,000.00	\$1,000.00
1.4	Construction setout and level control	1	Item	\$5,000.00	\$5,000.00
2	RETARDATION BASIN WORKS				
2.1	Stripping and stockpiling of 100mm of topsoil. Stockpile location to be nominated by the Superintendent	6900	m ²	\$0.50	\$3,450.00
2.2	Formation and earthworks in construction of the basin including formation of access tracks where required and	7900	m ³	\$7.50	\$59,250.00
2.3	Formation and construction of access tracks consisting of 150mm thick layer of Class 3 FCR compacted to 98%	514	m ²	\$35.00	\$17,990.00
2.4	Loading, carting and spreading topsoil from stockpiles on site to top dress the basin floor and batters.	6900	m ²	\$0.50	\$3,450.00
2.5	Supply and placement of basin clay lining	1800	m ³	\$15.00	\$27,000.00
2.6	Perimeter chain mesh fencing and gate	465	m	\$15.00	\$6,975.00
2.7	Tree planting	1	Item	\$7,500.00	\$7,500.00
2.8	Supply and placement of basin floor vegetation (WSUD measures)	1	Item	\$5,000.00	\$5,000.00
2.9	Supply and placement of Type 3 (300mm) beaching including A44 geotextile or equivalent.	171	m ²	\$150.00	\$25,650.00
2.10	Stormwater Pump Station including suction inlet, uPVC rising main and structure	1	Item	\$100,000.00	\$100,000.00
2.11	3 phase power supply to new pumps station	1	Item	\$10,000.00	\$10,000.00
3.0	DRAINAGE WORKS				
3.1	Trenched Pipework Supply of materials and installation of Class 2 RRJRC stormwater pipes including excavation of trench, laying of pipes, placing and compaction of backfill as specified.				
3.1.1	750mm diameter	194	m	\$400.00	\$77,600.00
3.1.2	600mm diameter	44	m	\$300.00	\$13,200.00
3.1.4	375mm diameter	14	m	\$200.00	\$2,800.00
3.1.5	300mm diameter	29	m	\$170.00	\$4,930.00
3.2	Supply of materials and installation of Class 4 butt joint jacking stormwater pipes including excavation of trench, laying of pipes, placing and compaction of backfill as specified.				
3.2.1	750mm diameter	67	m	\$600.00	\$40,200.00
3.2.2	600mm diameter	14	m	\$450.00	\$6,300.00
3.3	Bored Pipework Supply of materials and installation of Class 4 butt joint jacking stormwater pipes including all materials and equipment associated with the under highway and rail bores including provision of all site and traffic management plans that accord with the relevant authorities requirements.				
3.3.1	750mm diameter	86	m	\$1,100.00	\$94,600.00
3.3.2	600mm diameter	10	m	\$950.00	\$9,500.00
3.4	Construction of drainage pits including excavation, supply of all materials, formwork, provision of pipe connections and for future pipe connections, including plugging, subsoil drainage, entry and exit points, lids and frames, supply and compaction of backfilling, repair of pavement where required and disposal of surplus excavated material as directed.				
3.4.1	1250 x 1250 junction pit	9	No.	\$3,000.00	\$27,000.00
3.4.2	600 x 600 junction pit	1	No.	\$2,200.00	\$2,200.00
3.4.3	1250 x 1250 grated top entry pit	2	No.	\$3,000.00	\$6,000.00
3.4.4	900 x 900 grated top entry pit	2	No.	\$2,800.00	\$5,600.00
3.4.5	450 x 450 grated top entry pit & oriface plate (Pit C2)	1	No.	\$2,200.00	\$2,200.00
3.4.6	Remove and dispose of existing pit and construct a new 1200 x 900 side entry pit (haunched) - (Pit K1)	1	No.	\$2,500.00	\$2,500.00
3.4.7	Precast Concrete Endwall (OUTLET)	1	No.	\$1,500.00	\$1,500.00
3.4.8	Drivable endwalls to suit 375mm culvert	2	No.	\$1,500.00	\$3,000.00
	TOTAL				\$596,395.00

CONGUPNA STAGE 2 - OPTION 1

Item No.	Description of Work	Estimated Quantity	Unit	Rate \$	Extended Amount \$ (GST Excl.)
1.0	GENERAL				
1.1	Site establishment, permits, and insurances.	1	Item	\$5,000.00	\$5,000.00
1.2	Site management: preparation of a Management Plan including site management, environmental management and OH&S systems where required.	1	Item	\$15,000.00	\$15,000.00
1.3	Traffic Management	1	Item	\$10,000.00	\$10,000.00
1.4	Service location and identification including DBYD and non destructive depthing as required including protection of services at all times.	1	Item	\$5,000.00	\$5,000.00
1.5	Construction setout and level control	1	Item	\$4,000.00	\$4,000.00
1.6	Removal and reinstatement of existing road signage and bollards	1	Item	\$2,500.00	\$2,500.00
1.7	Replacement of existing undermined 100mm dia. uPVC water main with DICL pipework in accordance with GV Water Standard Drawing W-11(b).	1	Item	\$3,000.00	\$3,000.00
2	DRAINAGE WORKS				
2.1	Demolition and disposal of redundant drainage infrastructure	30	m	\$150.00	\$4,500.00
2.2	Earthworks and re-shaping of existing roadside table drain	560	m ²	\$10.00	\$5,600.00
2.3	Trenched Pipework				
2.3.1	Supply of materials and installation of Class 2 RRJRC stormwater pipes including excavation of trench, laying of pipes, placing and compaction of backfill as specified, and making good of existing surfaces.				
2.3.1.1	525mm diameter	107	m	\$280.00	\$29,960.00
2.3.1.2	450mm diameter	9	m	\$250.00	\$2,250.00
2.3.1.3	375mm diameter	338	m	\$200.00	\$67,600.00
2.3.2	Supply of materials and installation of Class 4 RRJRC stormwater pipes including excavation of trench, laying of pipes, placing and compaction of backfill as specified, and making good of existing surfaces.				
2.3.2.1	300mm diameter	3	m	\$220.00	\$660.00
2.4	Bored Pipework				
	Supply of materials and installation of Class 4 butt joint jacking stormwater pipes including all materials and equipment associated with the under highway including provision of all site and traffic management plans that accord with the relevant authorities requirements.				
2.4.1	450mm diameter	23	m	\$875.00	\$20,125.00
2.5	Construction of drainage pits including excavation, supply of all materials, formwork, provision of pipe connections and for future pipe connections, including plugging, subsoil drainage, entry and exit points, lids and frames, step irons if required, supply and compaction of backfilling, repair of pavement where required and disposal of surplus excavated material as directed.				
2.5.1	900 x 1200 side entry pit	3	No.	\$2,600.00	\$7,800.00
2.5.2	900 x 900 junction pit	6	No.	\$2,200.00	\$13,200.00
2.5.3	900 x 900 grated top entry pit	3	No.	\$2,000.00	\$6,000.00
2.5.4	1250 x 900 junction pit with batescrew valve (Pit 11)	1	No.	\$4,000.00	\$4,000.00
3.0	BORING WORKS				
3.1	Supply of all materials and equipment associated with the under highway and rail bores including provision of all site and traffic management plans that accord with the relevant authorities requirements.				
3.1.1	450mm dia. Under Katamitite - Shepparton Road	1	Item		
				TOTAL	\$206,195.00

CONGUPNA STAGE 3 - OPTION 1

Item No.	Description of Work	Estimated Quantity	Unit	Rate \$	Extended Amount \$ (GST Excl.)
1.0	GENERAL				
1.1	Site establishment, permits, and insurances.	1	Item	\$5,000.00	\$5,000.00
1.2	Site management: preparation of a Management Plan including site management, environmental management and OH&S systems where required.	1	Item	\$15,000.00	\$15,000.00
1.3	Traffic Management	1	Item	\$5,000.00	\$5,000.00
1.5	Construction setout and level control	1	Item	\$2,500.00	\$2,500.00
2	RETARDATION BASIN				
2.1	Stripping and stockpiling of 100mm of topsoil. Stockpile location to be nominated by the Superintendent	6500	m ²	\$0.50	\$3,250.00
2.2	Formation and earthworks in construction of the basin including formation of access tracks where required	4500	m ³	\$10.00	\$45,000.00
2.3	Formation and construction of access tracks consisting of 150mm thick layer of Class 3 FCR compacted to 98%	290	m ²	\$25.00	\$7,250.00
2.4	Loading, carting and spreading topsoil from stockpiles on site to top dress the basin floor and batters.	6900	m ²	\$0.50	\$3,450.00
2.5	Reworking and compaction of 300mm basin lining layer.	1950	m ³	\$10.00	\$19,500.00
2.6	Perimeter rural post & wire fencing and gate	180.5	m	\$13.50	\$2,436.75
2.8	Supply and planting of basin floor vegetation (WSUD measures)	1	Item	\$2,500.00	\$2,500.00
2.9	Supply and placement of Type 1 (300mm) beaching including A44 geotextile or equivalent.	65	m ²	\$70.00	\$4,550.00
2.10	Stormwater Pump Station including suction pipeline, delivery pipeline and structures	1	Item	\$100,000.00	\$100,000.00
2.11	3 phase power supply to new pumps station	1	Item	\$10,000.00	\$10,000.00
3.0	DRAINAGE				
3.1	Supply of materials and installation of Class 2 RRJRC stormwater pipes including excavation of trench, laying of pipes, placing and compaction of backfill as specified.				
3.1.1	450mm diameter	155	m	\$250.00	\$38,750.00
3.1.2	300mm diameter	27	m	\$200.00	\$5,400.00
3.2	Construction of drainage pits including excavation, supply of all materials, formwork, provision of pipe connections and for future pipe connections, including plugging, subsoil drainage, entry and exit points, lids and frames, step irons if required, supply and compaction of backfilling, repair of pavement where required and disposal of surplus excavated material as directed.				
3.2.1	900 x 900 junction pit	3	No.	\$2,500.00	\$7,500.00
3.2.2	600 x 600 junction pit	1	No.	\$2,200.00	\$2,200.00
3.2.3	900 x 900 grated top entry pit	2	No.	\$2,600.00	\$5,200.00
3.2.4	450 x 450 grated top entry pit & oriface plate	1	No.	\$2,220.00	\$2,220.00
3.2.5	Pit A5 - GMW Fram drain inlet pit	1	No.	\$2,500.00	\$2,500.00
3.2.6	Precast Concrete Endwall	1	No.	\$1,500.00	\$1,500.00
3.3	Formation and earthworks in construction of catch drain within adjacent farming land around the perimeter of the retardation basin	160	m	\$10.00	\$1,600.00
3.4	Decommissioning, plugging of pipework, removal of endwall and reshaping of batter of existing culvert on Wallace Street.	1	No.	\$1,500.00	\$1,500.00
3.5	Repair the GMW drain as and where required to the satisfaction of the responsible authority	1	No.	\$1,500.00	\$1,500.00
				TOTAL	\$295,306.75



1:1000 (A1 SIZE) 0 10 20 40 60 80m

NOT TO SCALE
REDUCED TO A3

CONCEPT ONLY

Greater Shepparton City Council
90 Watford St, Shepparton VIC 3632
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E: council@shepparton.vic.gov.au
W: www.greater-shepparton.com.au



CONGUPNA STAGE 3 DRAINAGE ALIGNMENT EVALUATION OPTION 2

TRIM REFERENCE: M16/56710

Congupna Urban Drainage Upgrade - Option 2

	Estimated construction cost	
Congupna Stage 1	\$	760,290.00
Congupna Stage 2	\$	196,195.00
Congupna Stage 3	\$	229,750.00
Total exl GST (no contingency)	\$	1,186,235.00

CONGUPNA STAGE 1 - OPTION 2

Item No.	Description of Work	Estimated Quantity	Unit	Rate \$	Extended Amount \$ (GST Excl.)
1.0	GENERAL				
1.1	Site establishment, permits, and insurances.	1	Item	\$5,000.00	\$5,000.00
1.2	Site management: preparation of a Management Plan including site management, environmental management and OH&S systems where required.	1	Item	\$30,000.00	\$30,000.00
1.3	Traffic Management	1	Item	\$1,000.00	\$1,000.00
1.4	Construction setout and level control	1	Item	\$10,000.00	\$10,000.00
2	RETARDATION BASIN WORKS				
2.1	Stripping and stockpiling of 100mm of topsoil. Stockpile location to be nominated by the Superintendent	13400	m ²	\$0.50	\$6,700.00
2.2	Formation and earthworks in construction of the basin including formation of access tracks where required and	12400	m ³	\$7.50	\$93,000.00
2.3	Formation and construction of access tracks consisting of 150mm thick layer of Class 3 FCR compacted to 98%	804	m ²	\$35.00	\$28,140.00
2.4	Loading, carting and spreading topsoil from stockpiles on site to top dress the basin floor and batters.	13400	m ²	\$0.50	\$6,700.00
2.5	Supply and placement of basin clay lining	2800	m ³	\$15.00	\$42,000.00
2.6	Perimeter chain mesh fencing and gate	520	m	\$15.00	\$7,800.00
2.7	Tree planting	1	Item	\$9,000.00	\$9,000.00
2.8	Supply and planting of basin floor vegetation (WSUD measures)	1	Item	\$7,000.00	\$7,000.00
2.9	Supply and placement of Type 3 (300mm) beaching including A44 geotextile or equivalent.	171	m ²	\$150.00	\$25,650.00
2.10	Stormwater Pump Station including suction inlet, uPVC rising main and structure	1	Item	\$100,000.00	\$100,000.00
2.11	3 phase power supply to new pumps station	1	Item	\$10,000.00	\$10,000.00
3.0	DRAINAGE WORKS				
3.1	Trenched Pipework Supply of materials and installation of Class 2 RRJRC stormwater pipes including excavation of trench, laying of pipes, placing and compaction of backfill as specified.				
3.1.1	900mm diameter	154	m	\$710.00	\$109,340.00
3.1.2	600mm diameter	44	m	\$300.00	\$13,200.00
3.1.4	375mm diameter	14	m	\$200.00	\$2,800.00
3.1.5	300mm diameter	29	m	\$170.00	\$4,930.00
3.2	Supply of materials and installation of Class 4 butt joint jacking stormwater pipes including excavation of trench, laying of pipes, placing and compaction of backfill as specified.				
3.2.1	900mm diameter	67	m	\$910.00	\$60,970.00
3.2.2	600mm diameter	14	m	\$450.00	\$6,300.00
3.3	Bored Pipework Supply of materials and installation of Class 4 butt joint jacking stormwater pipes including all materials and equipment associated with the under highway and rail bores including provision of all site and traffic management plans that accord with the relevant authorities requirements.				
3.3.1	900mm diameter	86	m	\$1,410.00	\$121,260.00
3.3.2	600mm diameter	10	m	\$950.00	\$9,500.00
3.4	Construction of drainage pits including excavation, supply of all materials, formwork, provision of pipe connections and for future pipe connections, including plugging, subsoil drainage, entry and exit points, lids and frames, supply and compaction of backfilling, repair of pavement where required and disposal of surplus excavated material as directed.				
3.4.1	1250 x 1250 junction pit	9	No.	\$3,000.00	\$27,000.00
3.4.2	600 x 600 junction pit	1	No.	\$2,200.00	\$2,200.00
3.4.3	1250 x 1250 grated top entry pit	2	No.	\$3,000.00	\$6,000.00
3.4.4	900 x 900 grated top entry pit	2	No.	\$2,800.00	\$5,600.00
3.4.5	450 x 450 grated top entry pit & oriface plate (Pit C2)	1	No.	\$2,200.00	\$2,200.00
3.4.6	Remove and dispose of existing pit and construct a new 1200 x 900 side entry pit (haunched) - (Pit K1)	1	No.	\$2,500.00	\$2,500.00
3.4.7	Precast Concrete Endwall (OUTLET)	1	No.	\$1,500.00	\$1,500.00
3.4.8	Drivable endwalls to suit 375mm culvert	2	No.	\$1,500.00	\$3,000.00
	TOTAL				\$760,290.00

CONGUPNA STAGE 2 - OPTION 2

Item No.	Description of Work	Estimated Quantity	Unit	Rate \$	Extended Amount \$ (GST Excl.)
1.0	GENERAL				
1.1	Site establishment, permits, and insurances.	1	Item	\$5,000.00	\$5,000.00
1.2	Site management: preparation of a Management Plan including site management, environmental management and OH&S systems where required.	1	Item	\$10,000.00	\$10,000.00
1.3	Traffic Management	1	Item	\$5,000.00	\$5,000.00
1.4	Service location and identification including DBYD and non destructive depthing as required including protection of services at all times.	1	Item	\$5,000.00	\$5,000.00
1.5	Construction setout and level control	1	Item	\$4,000.00	\$4,000.00
1.6	Removal and reinstatement of existing road signage and bollards	1	Item	\$2,500.00	\$2,500.00
1.7	Replacement of existing undermined 100mm dia. uPVC water main with DICL pipework in accordance with GV Water Standard Drawing W-11(b).	1	Item	\$3,000.00	\$3,000.00
2	DRAINAGE WORKS				
2.1	Demolition and disposal of redundant drainage infrastructure	30	m	\$150.00	\$4,500.00
2.2	Earthworks and re-shaping of existing roadside table drain	560	m ²	\$10.00	\$5,600.00
2.3	Trenched Pipework				
2.3.1	Supply of materials and installation of Class 2 RRJRC stormwater pipes including excavation of trench, laying of pipes, placing and compaction of backfill as specified, and making good of existing surfaces.				
2.3.1.1	525mm diameter	107	m	\$280.00	\$29,960.00
2.3.1.2	450mm diameter	9	m	\$250.00	\$2,250.00
2.3.1.3	375mm diameter	338	m	\$200.00	\$67,600.00
2.3.2	Supply of materials and installation of Class 4 RRJRC stormwater pipes including excavation of trench, laying of pipes, placing and compaction of backfill as specified, and making good of existing surfaces.				
2.3.2.1	300mm diameter	3	m	\$220.00	\$660.00
2.4	Bored Pipework				
	Supply of materials and installation of Class 4 butt joint jacking stormwater pipes including all materials and equipment associated with the under highway including provision of all site and traffic management plans that accord with the relevant authorities requirements.				
2.4.1	450mm diameter	23	m	\$875.00	\$20,125.00
2.5	Construction of drainage pits including excavation, supply of all materials, formwork, provision of pipe connections and for future pipe connections, including plugging, subsoil drainage, entry and exit points, lids and frames, step irons if required, supply and compaction of backfilling, repair of pavement where required and disposal of surplus excavated material as directed.				
2.5.1	900 x 1200 side entry pit	3	No.	\$2,600.00	\$7,800.00
2.5.2	900 x 900 junction pit	6	No.	\$2,200.00	\$13,200.00
2.5.3	900 x 900 grated top entry pit	3	No.	\$2,000.00	\$6,000.00
2.5.4	1250 x 900 junction pit with batescrew valve (Pit 11)	1	No.	\$4,000.00	\$4,000.00
3.0	BORING WORKS				
3.1	Supply of all materials and equipment associated with the under highway and rail bores including provision of all site and traffic management plans that accord with the relevant authorities requirements.				
3.1.1	450mm dia. Under Katamitite - Shepparton Road	1	Item		
				TOTAL	\$196,195.00

CONGUPNA STAGE 3 - OPTION 2

Item No.	Description of Work	Estimated Quantity	Unit	Rate \$	Extended Amount \$ (GST Excl.)
1.0	GENERAL				
1.1	Site establishment, permits, and insurances.	1	Item	\$5,000.00	\$5,000.00
1.2	Site management: preparation of a Management Plan including site management, environmental management and OH&S systems where required.	1	Item	\$15,000.00	\$15,000.00
1.3	Traffic Management	1	Item	\$5,000.00	\$5,000.00
1.5	Construction setout and level control	1	Item	\$2,500.00	\$2,500.00
3.0	DRAINAGE				
3.1	Regrading and reshaping of Wallace Street roadside drains	1100	m	\$12.00	\$13,200.00
3.2	Existing concrete access crossovers saw-cut, existing culvert removed, new 300mm diameter culverts installed (3 pipes) at new grades/levels complete with new drivable endwalls and reinstate saw-cut concrete	24	Item	\$6,200.00	\$148,800.00
3.3	Existing road culvert removed, new 300mm diameter culverts installed (5 pipes) at new grades/levels complete with new drivable endwalls and reinstate road pavement	2	Item	\$6,000.00	\$12,000.00
3.1	Supply of materials and installation of Class 2 RRJRC stormwater pipes including excavation of trench, laying of pipes, placing and compaction of backfill as specified.				
3.1.1	600mm diameter (full depth crushed rock backfill)	45	m	\$450.00	\$20,250.00
3.2	Construction of drainage pits including excavation, supply of all materials, formwork, provision of pipe connections and for future pipe connections, including plugging, subsoil drainage, entry and exit points, lids and frames, step irons if required, supply and compaction of backfilling, repair of pavement where required and disposal of surplus excavated material as directed.				
3.2.1	900 x 900 junction pit	2	No.	\$2,500.00	\$5,000.00
3.4	Decommissioning, plugging of pipework, removal of endwall and reshaping of batter of existing culvert on Wallace Street.	1	No.	\$1,500.00	\$1,500.00
3.5	Repair the GMW drain as and where required to the satisfaction of the responsible authority	1	No.	\$1,500.00	\$1,500.00
				TOTAL	\$229,750.00

Congupna Urban Drainage Upgrade - Option 3

	Estimated construction cost	
Congupna Stage 1	\$	760,290.00
Congupna Stage 2	\$	220,158.00
Congupna Stage 3	\$	103,625.00
Total exl GST (no contingency)	\$	1,084,073.00

CONGUPNA STAGE 1 - OPTION 3

Item No.	Description of Work	Estimated Quantity	Unit	Rate \$	Extended Amount \$ (GST Excl.)
1.0	GENERAL				
1.1	Site establishment, permits, and insurances.	1	Item	\$5,000.00	\$5,000.00
1.2	Site management: preparation of a Management Plan including site management, environmental management and OH&S systems where required.	1	Item	\$30,000.00	\$30,000.00
1.3	Traffic Management	1	Item	\$1,000.00	\$1,000.00
1.4	Construction setout and level control	1	Item	\$10,000.00	\$10,000.00
2	RETARDATION BASIN WORKS				
2.1	Stripping and stockpiling of 100mm of topsoil. Stockpile location to be nominated by the Superintendent	13400	m ²	\$0.50	\$6,700.00
2.2	Formation and earthworks in construction of the basin including formation of access tracks where required and	12400	m ³	\$7.50	\$93,000.00
2.3	Formation and construction of access tracks consisting of 150mm thick layer of Class 3 FCR compacted to 98%	804	m ²	\$35.00	\$28,140.00
2.4	Loading, carting and spreading topsoil from stockpiles on site to top dress the basin floor and batters.	13400	m ²	\$0.50	\$6,700.00
2.5	Supply and placement of basin clay lining	2800	m ³	\$15.00	\$42,000.00
2.6	Perimeter chain mesh fencing and gate	520	m	\$15.00	\$7,800.00
2.7	Tree planting	1	Item	\$9,000.00	\$9,000.00
2.8	Supply and planting of basin floor vegetation (WSUD measures)	1	Item	\$7,000.00	\$7,000.00
2.9	Supply and placement of Type 3 (300mm) beaching including A44 geotextile or equivalent.	171	m ²	\$150.00	\$25,650.00
2.10	Stormwater Pump Station including suction inlet, uPVC rising main and structure	1	Item	\$100,000.00	\$100,000.00
2.11	3 phase power supply to new pumps station	1	Item	\$10,000.00	\$10,000.00
3.0	DRAINAGE WORKS				
3.1	Trenched Pipework Supply of materials and installation of Class 2 RRJRC stormwater pipes including excavation of trench, laying of pipes, placing and compaction of backfill as specified.				
3.1.1	900mm diameter	154	m	\$710.00	\$109,340.00
3.1.2	600mm diameter	44	m	\$300.00	\$13,200.00
3.1.4	375mm diameter	14	m	\$200.00	\$2,800.00
3.1.5	300mm diameter	29	m	\$170.00	\$4,930.00
3.2	Supply of materials and installation of Class 4 butt joint jacking stormwater pipes including excavation of trench, laying of pipes, placing and compaction of backfill as specified.				
3.2.1	900mm diameter	67	m	\$910.00	\$60,970.00
3.2.2	600mm diameter	14	m	\$450.00	\$6,300.00
3.3	Bored Pipework Supply of materials and installation of Class 4 butt joint jacking stormwater pipes including all materials and equipment associated with the under highway and rail bores including provision of all site and traffic management plans that accord with the relevant authorities requirements.				
3.3.1	900mm diameter	86	m	\$1,410.00	\$121,260.00
3.3.2	600mm diameter	10	m	\$950.00	\$9,500.00
3.4	Construction of drainage pits including excavation, supply of all materials, formwork, provision of pipe connections and for future pipe connections, including plugging, subsoil drainage, entry and exit points, lids and frames, supply and compaction of backfilling, repair of pavement where required and disposal of surplus excavated material as directed.				
3.4.1	1250 x 1250 junction pit	9	No.	\$3,000.00	\$27,000.00
3.4.2	600 x 600 junction pit	1	No.	\$2,200.00	\$2,200.00
3.4.3	1250 x 1250 grated top entry pit	2	No.	\$3,000.00	\$6,000.00
3.4.4	900 x 900 grated top entry pit	2	No.	\$2,800.00	\$5,600.00
3.4.5	450 x 450 grated top entry pit & oriface plate (Pit C2)	1	No.	\$2,200.00	\$2,200.00
3.4.6	Remove and dispose of existing pit and construct a new 1200 x 900 side entry pit (haunched) - (Pit K1)	1	No.	\$2,500.00	\$2,500.00
3.4.7	Precast Concrete Endwall (OUTLET)	1	No.	\$1,500.00	\$1,500.00
3.4.8	Drivable endwalls to suit 375mm culvert	2	No.	\$1,500.00	\$3,000.00
	TOTAL				\$760,290.00

CONGUPNA STAGE 2 - OPTION 3

Item No.	Description of Work	Estimated Quantity	Unit	Rate \$	Extended Amount \$ (GST Excl.)
1.0	GENERAL				
1.1	Site establishment, permits, and insurances.	1	Item	\$5,000.00	\$5,000.00
1.2	Site management: preparation of a Management Plan including site management, environmental management and OH&S systems where required.	1	Item	\$10,000.00	\$10,000.00
1.3	Traffic Management	1	Item	\$5,000.00	\$5,000.00
1.4	Service location and identification including DBYD and non destructive depthing as required including protection of services at all times.	1	Item	\$5,000.00	\$5,000.00
1.5	Construction setout and level control	1	Item	\$4,000.00	\$4,000.00
1.6	Removal and reinstatement of existing road signage and bollards	1	Item	\$2,500.00	\$2,500.00
1.7	Replacement of existing undermined 100mm dia. uPVC water main with DICL pipework in accordance with GV Water Standard Drawing W-11(b).	1	Item	\$3,000.00	\$3,000.00
2	DRAINAGE WORKS				
2.1	Demolition and disposal of redundant drainage infrastructure	30	m	\$150.00	\$4,500.00
2.2	Earthworks and re-shaping of existing roadside table drain	560	m ²	\$10.00	\$5,600.00
2.3	Trenched Pipework				
2.3.1	Supply of materials and installation of Class 2 RRJRC stormwater pipes including excavation of trench, laying of pipes, placing and compaction of backfill as specified, and making good of existing surfaces.				
2.3.1.1	750mm diameter	107	m	\$400.00	\$42,800.00
2.3.1.1	600mm diameter	143.83	m	\$300.00	\$43,149.00
2.3.1.3	375mm diameter	189.12	m	\$200.00	\$37,824.00
2.3.2	Supply of materials and installation of Class 4 RRJRC stormwater pipes including excavation of trench, laying of pipes, placing and compaction of backfill as specified, and making good of existing surfaces.				
2.3.2.1	300mm diameter	3	m	\$220.00	\$660.00
2.4	Bored Pipework				
	Supply of materials and installation of Class 4 butt joint jacking stormwater pipes including all materials and equipment associated with the under highway including provision of all site and traffic management plans that accord with the relevant authorities requirements.				
2.4.1	450mm diameter	23	m	\$875.00	\$20,125.00
2.5	Construction of drainage pits including excavation, supply of all materials, formwork, provision of pipe connections and for future pipe connections, including plugging, subsoil drainage, entry and exit points, lids and frames, step irons if required, supply and compaction of backfilling, repair of pavement where required and disposal of surplus excavated material as directed.				
2.5.1	900 x 1200 side entry pit	3	No.	\$2,600.00	\$7,800.00
2.5.2	900 x 900 junction pit	6	No.	\$2,200.00	\$13,200.00
2.5.3	900 x 900 grated top entry pit	3	No.	\$2,000.00	\$6,000.00
2.5.4	1250 x 900 junction pit with batescrew valve (Pit 11)	1	No.	\$4,000.00	\$4,000.00
3.0	BORING WORKS				
3.1	Supply of all materials and equipment associated with the under highway and rail bores including provision of all site and traffic management plans that accord with the relevant authorities requirements.				
3.1.1	450mm dia. Under Katamitite - Shepparton Road	1	Item		
				TOTAL	\$220,158.00

CONGUPNA STAGE 3 - OPTION 3

Item No.	Description of Work	Estimated Quantity	Unit	Rate \$	Extended Amount \$ (GST Excl.)
1.0	GENERAL				
1.1	Site establishment, permits, and insurances.	1	Item	\$5,000.00	\$5,000.00
1.2	Site management: preparation of a Management Plan including site management, environmental management and OH&S systems where required.	1	Item	\$5,000.00	\$5,000.00
1.3	Traffic Management	1	Item	\$2,500.00	\$2,500.00
1.4	Construction setout and level control	1	Item	\$2,500.00	\$2,500.00
1.5	Demolition and disposal of redundant drainage infrastructure	55	m	\$150.00	\$8,250.00
1.6	Sawcut and remove section of concrete footpath	4.5	m ²	\$150.00	\$675.00
3.0	DRAINAGE				
3.1	Supply of materials and installation of Class 2 RRJRC stormwater pipes including excavation of trench, laying of pipes, placing and compaction of backfill as specified.				
3.1.1	600mm diameter	55	m	\$300.00	\$16,500.00
3.1.2	450mm diameter	165	m	\$250.00	\$41,250.00
3.2.6	Precast Concrete Endwall	1	No.	\$1,500.00	\$1,500.00
3.2	Construction of drainage pits including excavation, supply of all materials, formwork, provision of pipe connections and for future pipe connections, including plugging, subsoil drainage, entry and exit points, lids and frames, step irons if required, supply and compaction of backfilling, repair of pavement where required and disposal of surplus excavated material as directed.				
3.2.1	900 x 900 junction pit	4	No.	\$2,500.00	\$10,000.00
3.2.2	900 x 1200 side entry pit	2	No.	\$2,600.00	\$5,200.00
3.4	Decommissioning, plugging of pipework, removal of endwall and reshaping of batter of existing culvert on Wallace Street.	1	No.	\$1,500.00	\$1,500.00
3.5	Repair the GMW drain as and where required to the satisfaction of the resposible authority	1	No.	\$1,500.00	\$1,500.00
					\$0.00
4.0	New Conc. Footpath with SL72 Mesh & 125mm depth Class 3 20mm FCR	4.5	m ²	\$500.00	\$2,250.00
				TOTAL	\$103,625.00