

Flagstone UDA

Sewerage Servicing Strategy

7217-43 Version 1

Prepared for
Urban Land Development Authority
11 October 2012



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1 Introduction

This report investigates the short-medium term sewerage servicing solutions for the Flagstone UDA and expands on the Logan Water Alliance (LWA) Task 90-11-19: Logan South Wastewater Servicing Plan (February 2012) which made preliminary recommendations on the preferred long, medium and short term sewerage servicing strategies given the planned development in Greater Flagstone. The LWA report concluded that two strategies were comparable, "making recommendation of a preferred strategy difficult". These included Option 3C, delivering yields to an interim Cedar Grove STP plant prior to delivery of the regional Cedar Grove STP facility in 2016, and Option 1A, an interim connection to Loganholme STP via Greenbank and Regents Park prior to delivery and reversal of flows from Flagstone City to the regional Cedar Grove STP facility in 2021.

Capital expenditure reported as part of LWA Task 90-11-19 required approximately \$137M and \$128M for Option 1A and Option 3C respectively, with the majority of funds required for provision of the regional Cedar Grove STP during the later years.

Whilst LWA planning has considered a treatment facility at Cedar Grove in 2016, it is understood that Logan City Council (LCC) are not able to commit to the delivery of the regional Cedar Grove STP until prevailing yields within the catchment can support its sustainable operation. Indicatively, the LWA report recommended a 3ML/d first stage for the regional Cedar Grove STP, which would require minimum yields of at least 1.5ML/d or 7,500EP within the catchment to maintain sustainable operations. Recent discussions with LCC indicate that the preferred roll out of the first phase of the ultimate works at Cedar Grove would be a 5ML/d plant which could be triggered by flows of 2ML/d or 10,000EP. This is expected to be achieved by 2021. This report considers.

It is understood that ULDA Catalyst funds are limited to approximately \$20M to accommodate interim measures prior to delivery of the regional Cedar Grove STP. The following report takes account of funding constraints and explores the most relevant options for the sewerage servicing until minimum yields can be delivered to Cedar Grove.

Objectives of this report will be to:

- > Rationalise the findings of previous studies to find the most relevant and affordable short-medium term strategy within the context of ULDA Catalyst funding constraints;
- > Promote Logan City Council's long term goals for sustainable and affordable infrastructure development.

The report reviews alternative short-medium term strategies broadly categorised by either

- i) conveyance and treatment at the proposed Cedar Grove STP or
- ii) conveyance to the Loganholme STP.

2 Local Areas and Adopted Populations

The Greater Flagstone UDA includes a number of distinct development areas that are likely to progress in the short to medium term. These include:

- > Flagstone East – continuing development, east of the rail line;
- > Flagstone North – development of Teviot Downs and North Maclean;
- > Flagstone City – development west of the rail line;
- > Riverbend/Gittens – ULDA jurisdiction development, identified as early release precinct.

It is recognised that other development interests are located within the UDA although these are not considered readily serviced given their location and are unlikely to impact on the outlined proposals.

External to the UDA growth is expected in the Park Ridge area and this is accounted for in the assessment.

Populations in this report are intended to inform the sizing of trunk infrastructure; they are considered indicative and subject to rationalisation between local areas. Populations adopted for this report are not intended to represent capacity allocations to any particular development interest.

Short-medium term population adopted for this assessment have been outlined in Table 2-1 below. This table represents growth and existing yield from the local area. They have been compiled from discussions with ULDA and the latest understanding of development initiatives. It is recognised that these assumptions will remain flexible and subject to change.

It is assumed that significant sewerage yields from new development will be delayed approximately one year after development construction. This represents the delay experienced during plan sealing and construction until habitation of dwellings.

Table 2-1 Adopted Short-Medium Term Populations

Local Area	2014	2016	2021
Flagstone East	2,950	2,950	2,950
Flagstone City	0	720	6,210
Riverbend/Gittens	0	432	1,800
Flagstone North	0	0	2,500
Park Ridge (local catchment only)	0	0	1,493 ²

Notes:

- 1) Where zero, any populations are assumed to be serviced by local treatment solutions.
- 2) Derived from Infoworks sewer model provided by LCC;

It is assumed for the purpose of this assessment that development within the UDA not outlined above would require interim local treatment solutions.

3 Short Term Service via Cedar Grove STP

The recommended solution from LWA Task: 90-11-19 Option 3C proposed delivery of yields to an interim Cedar Grove STP facility prior to delivery of the regional Cedar Grove STP facility. The existing Flagstone STP could be retained at current capacity (2,550EP) to compliment any short term measures. Package treatment capacity would be provided at the Cedar Grove STP site until delivery of the regional Cedar Grove STP.

Several variations of this strategy have been considered with the most optimal outlined below. Table 3-1 provides summary of capital costs. Figures 1 & 2 illustrate the proposed options. Detailed costs have been provided in Appendix A.

Table 3-1 Cedar Grove Options Considered

Option	Description	Costs
CG1	Diversion to Cedar Grove STP with capacity to service 9,100EP from the Flagstone City area and Riverbend/Gittens area. Service of the Flagstone North area shall be consistent with the provisions of LWA Task:90-11-19, Option 3C i.e. treatment at Loganholme.	\$30.1M
CG2	Diversion to Cedar Grove STP with capacity to service 11,000EP from the Flagstone City area and Riverbend/Gittens area. Service of the Flagstone North area shall be consistent with the provisions of LWA Task:90-11-19, Option 3C i.e. treatment at Loganholme.	\$40.3M

3.1 Option CG1

This option has been sized to service a yield of approximately 1,800EP for Riverbend/Gittens and 6,550EP Flagstone City, which is equivalent to the yield considered in Option FN2 (refer following Section 4.2).

Option CG1 includes diversion from Flagstone City to an interim Cedar Grove STP facility via 225-300mm diameter rising mains with supporting pump stations and gravity mains. Small scale interim treatment capacity is included at Cedar Grove with capacity to accommodate 8,350EP (including Riverbend/Gittens). Flagstone North will be serviced by the infrastructure identified in LWA Task 90-11-19 Option 3C i.e. treatment at Loganholme.

The gravity mains downstream from FL-PS-05 and SPS78 limit capacity to 6,550EP based upon new pipe criteria at minimum grade. Additional capacity may be realised if increased grades can be achieved. The pressure network could be extended up to approximately 8,000EP given complementary gravity network and pump station capacity.

Operations at Flagstone STP would be suspended with yields diverted to Cedar Grove STP to support sustainable operations of network infrastructure during the early years of operation. Flagstone STP would be recommissioned at existing capacity (2,550EP + proposed additional 400EP required under the existing IA) once network capacity is exceeded. Combined capacity for the Flagstone City / Riverbend/Gittens area will be 9,100EP prior to the delivery regional Cedar Grove STP.

Ultimate development would require two additional transport infrastructure stages making all early transport infrastructure redundant soon after delivery of the regional Cedar Grove STP. Similarly, it is expected that all interim treatment works provided at Cedar Grove to service short term demand would become redundant with the delivery of the regional Cedar Grove STP.

The anticipated populations from Flagstone North are not expected to fully utilise proposed sewerage infrastructure from Greenbank to Regents Park by 2021.

3.1.1 Value assessment

Option CG1 services a combined yield of 13,400EP from the local areas of Flagstone North, Riverbend/Gittens and Flagstone City for capital expenditure of \$30.1M.

Indicatively the cost to satisfy short term servicing is \$2,250/EP.

This cost does not account for the operational costs, particularly those associated with suspending, maintaining and/or operating Flagstone STP and operating the interim Cedar Grove STP. In addition, this cost does not value the spare capacity of the Flagstone North transfer to Loganholme STP.

3.2 Option CG2

This option has been sized to service a yield of approximately 1,800EP for Riverbend/Gittens and 11,000EP Flagstone City, which is equivalent to the yield considered in Option FN2 (refer following Section 4.2) and LWA Task 90-11-19, Option 3C.

Option CG2 proposes a diversion from Flagstone City to Cedar Grove STP facility via 250-375mm diameter rising mains with supporting pump stations and gravity mains. Small scale interim treatment capacity is included at Cedar Grove with capacity to accommodate 12,800EP. Flagstone North would be serviced by the infrastructure identified in LWA Task 90-11-19 Option 3C i.e. treatment at Loganholme.

The proposed transport infrastructure has some spare capacity to service additional development. This additional transport capacity is not considered in comparative analysis as there would be associated interim treatment costs if this capacity was utilised. In this regard, the gravity mains downstream from FL-PS-05 and SPS78 have capacity to service approximately 12,400EP based upon new pipe criteria at minimum grade. The pressure network could be extended to service up to approximately 12,800EP given complementary gravity network and pump station capacity.

Option CG2 capacity provides opportunity to decommission the Flagstone STP permanently subject to the provision of treatment capacity at Cedar Grove.

Ultimate development would require two additional transport infrastructure stages making all early transport infrastructure redundant soon after delivery of the regional Cedar Grove STP. Similarly, it is likely that all interim treatment works provided at Cedar Grove to service short term demand would become redundant with the delivery of the regional Cedar Grove STP.

3.2.1 Value assessment

Option CG2 services a combined yield of 15,300EP from Flagstone North, Flagstone East, Riverbend/Gittens and Flagstone City for capital expenditure of \$40.3M.

Indicatively the cost to satisfy short term service is \$2,600/EP.

This cost does not account for the operational costs, particularly those associated with suspending, maintaining and/or operating Flagstone STP and operating the interim Cedar Grove STP. In addition, this cost does not value the spare capacity of the Flagstone North transfer to Loganholme STP or the additional capacity of the Cedar Grove transfer mains.

4 Short Term Service via Loganholme STP

The concept to deliver all yields north via Regents Park prior to the delivery of the regional Cedar Grove STP facility and later reversal of flows from Flagstone City to Cedar Grove was considered in Option 1A of LWA Task: 90-11-19. This option was ranked highly in the LWA report but was not recommended due to marginal differences.

In this option yields are assumed to be delivered to the Loganholme STP until yields reach a level to trigger permanent treatment works at the regional Cedar Grove STP. Whilst flows from the southern areas of the Flagstone UDA would be reversed at that time, Flagstone North would not be reversed and would maintain permanent servicing via Loganholme STP. Similar to the above CG1 option, the existing Flagstone STP could be retained at current capacity (2,550EP+ proposed additional 400EP required under the existing 1A) to compliment any short term measures to the local area.

The transport of sewer from Riverbend/Gittens to the Flagstone North rising mains would be similar to the costs outlined in CG1, therefore, it has been concluded that it is more cost effective to assume Riverbend/Gittens would be supported by interim local treatment capacity. This approach allows for interim local treatment capacity at Riverbend/Gittens to be staged to align with development yield and avoids the potential for operational difficulties from oversized infrastructure during the initial years after development. The full treatment costs to meet the expected Riverbend/Gittens yield have been allowed for in the assessment. There will be a requirement to secure operating licences for the treatment works and associated irrigation areas.

Table 4-1 provides a summary of capital costs. Figures 3 & 4 illustrate the proposed options. Detailed costs have been provided in Appendix A.

Table 4-1 Loganholme Options Considered

Option	Description	Costs
FN1	Diversion to Flagstone North with capacity to service 9,450EP from the Flagstone City area and 2,500EP from the Flagstone North local area. Local Riverbend/Gittens treatment.	\$19.3M
FN2	Diversion to Flagstone North with capacity to service 11,000EP from the Flagstone City area and 2,500EP from the Flagstone North local area. Local Riverbend/Gittens treatment.	\$21.6M

Analysis of the Infoworks model of the Greenbank – Regents Park network provided by LCC has informed this assessment.

4.1 Option FN1

The intent of Option FN1 is to maximise the potential from the transport infrastructure proposed from Flagstone North to Regents Park. It is proposed to divert flows from Flagstone City to Loganholme STP via Flagstone North. Service for 6,900EP from the Flagstone City area would be supported by 250mm diameter rising mains to Flagstone North. Pump stations FL-PS-05, FL-PS-02 and FL-PS-FN would pump north and discharge to a dedicated gravity main to GB-PS-01.

Proposed pump stations FL-PS-05 and FL-PS-02 are suitably located to service future gravity catchments of Flagstone City. Significant portions of the associated 250mm diameter FL-PS-05 and FL-PS-02 rising mains could be utilised in the future once flows are reversed for delivery to Cedar Grove STP.

Pump Station FL-PS-FN is necessary to break the head along the route to Flagstone North and has been located at one of the highest elevations along the route to conserve kinetic energy. That is, FL-PS-05 pumps into FL-PS-FN at approximately 60m AHD, which then pumps to the receiving network at Flagstone North at approximately 70m AHD. Thus, this proposal minimises the static lift required to be serviced by FL-PS-FN (10m). FL-PS-FN and the associated rising main will become redundant once FL-PS5 and FL-PS-2 are reversed to Cedar Grove STP.

The connection from Flagstone North to Regents Park would require marginal enhancements to temporarily support yields from Flagstone City. From comparison of the infrastructure cost schedules presented in Appendix A, the proposed connection

will require increases in the size of the pump station, rising main and gravity mains. An additional \$2.2M would be required to provide the additional capacity to accommodate yields from the Flagstone City area.

Operations at Flagstone STP would be suspended temporarily with yields diverted to Loganholme STP to support sustainable operations of network infrastructure during the early years of operation. Note, this would negate the need for temporary tankering or flushing of the network at Flagstone North (Teviot). These cost savings have not been included in the assessment. The Flagstone STP would be recommissioned at existing capacity (2,550EP + proposed additional 400EP required under the existing IA) before the network capacity is exceeded. Combined capacity for the Flagstone City and Flagstone North areas would be 9,100EP plus 2,500EP prior to the delivery of the regional Cedar Grove STP.

Once flows are reversed to the regional Cedar Grove STP, the additional capacity provided by Option FN1 will be relinquished to service further growth within Flagstone North. The enhancements provided by Option FN1 will provide additional capacity for Flagstone North than the provisions outlined in Option 3C of LWA Task:90-11-19. Subsequent augmentations would therefore be deferred due to this approach.

4.1.1 Value assessment

Option FN1 services a combined yield of 13,750EP from the local areas of Flagstone North, Riverbend/Gittens and Flagstone City for capital expenditure of \$19.3M.

Indicatively the cost for cost to provide short term servicing is \$1,400/EP.

This cost does not account for the operational costs, particularly those associated with suspending, maintaining and/or operating the Flagstone STP.

4.2 Option FN2

Option FN2 is in essence a larger capacity alternative to Option FN1. It is intended to provide opportunity to decommission the Flagstone STP permanently. Service for 11,000EP from the Flagstone City and Flagstone East local areas would be supported by 300mm diameter rising mains to Flagstone North. Pump stations FL-PS-05, FL-PS-02 and FL-PS-FN would pump north and discharge to a dedicated gravity main to GB-PS-01.

Only minimal enhancements would be required to the Flagstone North to Regents Park infrastructure when compared with Option FN1 (approx. increase 7% i.e. \$700k). A 375mm rising main would be maintained from GB-PS-01 but with larger pumps and an increase to some strategic gravity sewers. When compared with the split north-south option outlined in Option 3C of LWA Task: 90-11-19 and the CG1&2 options above an additional \$3.0M would be required to provide the additional capacity, refer infrastructure cost schedules presented in Appendix A. Note, the estimated cost of FN2 from Teviot to Greenbank is a \$1.3m increase above the provisional allocation allowed for in catalyst funds.

Once flows are reversed to the regional Cedar Grove STP, the additional capacity provided by Option FN2 will be relinquished to service growth within Flagstone North. The additional transfer capacity to Regents Park enabled by Option FN2 (13,500EP) would provide for the anticipated ultimate population of Flagstone North (12,000EP) without future augmentation.

As with Option FN1, proposed pump stations FL-PS-05 and FL-PS-02 are suitably located to service future gravity catchments of Flagstone City and development in the wider Flagstone UDA. Significant portions of the associated 300mm diameter FL-PS-05 and FL-PS-02 rising mains could be utilised in future once flows are reversed for delivery to Cedar Grove STP. Whilst the need to augment these mains is not negated, the 300mm diameter will enable significant capacity to defer future augmentations.

There is very limited opportunity in the Greenbank – Regents Park network to augment beyond the proposed 13,500EP capacity. Development outcomes significantly beyond this limit will trigger augmentation to major lengths of the downstream network and are outside the scope of this report.

4.2.1 Value assessment

Option FN2 services a combined yield of 15,300EP from the local areas of Flagstone North, Flagstone East, Riverbend/Gittens and Flagstone City for \$21.6M.

Indicatively, the cost to satisfy the short-medium term servicing is \$1,400/EP.

The benefits not reflected in this cost are:

- > lower operation and maintenance costs associated with decommissioning Flagstone STP;
- > No future augmentations to support Flagstone North ultimate populations; and
- > Significant capacity to defer the regional Cedar Grove STP.

5 Discussion and Recommendation

After considerable investigation, it is apparent from the conclusion in options CG1 and CG2 that the economics of short term servicing via Cedar Grove STP are not favourable. In general, the requirement to provide treatment capacity are cost prohibitive; therefore, short term service solutions via Cedar Grove have been discounted.

When compared with the Cedar Grove options, infrastructure servicing via the Loganholme option provides longer term opportunity. That is, rising mains can be reversed and reused and there is opportunity to size the Flagstone North connection to provide significant capacity to defer the ultimate works at Cedar Grove.

Operational sustainability and flexibility is a key criteria. In general, all options are reasonable but will not be without challenge. Specifically, none of the options strictly satisfy LCC Desired Standards of Service (DSS) regarding rising main detention time in the first years of operation. When considering the largest volume rising main, GB-PS-01 of Option FN2, it would be expected that detention would peak at 20 hours immediately after commissioning if no flows are diverted from the Flagstone STP. However, once service demands peak, detention times are expected to be within the 4 hour limits set out in the DSS. The temporary or permanent diversion of yields from Flagstone STP is an important consideration with respect to charging the mains to support sustainable operation and avoid the need for tankering of waste and/or flushing and chemical dosing of the network. It is considered that any detention concerns could be reasonably resolved and should not discredit an otherwise preferred option.

Options FN2 enables decommissioning of Flagstone STP and thus promotes centralised treatment objectives. Centralised treatment typically enables economies of scale and reduces operational treatment costs in lieu of operating numerous small treatment facilities. Similarly, it foregoes the operational expense of maintaining and recommissioning the Flagstone STP after several years out of service.

Comparatively, Option FN1 and FN2 are equal highest value for service with respect to cost/lot. Furthermore, the marginal cost difference between Option FN1 and Option FN2 may be off-set to a degree by avoiding the need to operate or temporarily decommission the Flagstone STP with Option FN2. From a whole life perspective there are also savings with respect to avoiding the need for future augmentations of the Greenbank – Regents Park network. In this regard, Option FN2 is recommended ahead of FN1 subject to the additional early capital being available.

It appears most beneficial for Riverbend/Gittens to provide onsite treatment capacity in accordance with their local development progression. This approach realises the economies of staged infrastructure delivery and minimises the potential for operational difficulties from oversized infrastructure during the initial years of development.

On balance, Option FN2 is recommended as the preferred infrastructure solution to service the Flagstone UDA in the short term. It has capacity to service all the expected Flagstone UDA early development areas whilst providing benefit to Logan City Council and the broader community.

The key benefits from pursuing the recommended Option FN2 can be summarised as follows:

- > Best value service (\$/EP) combined with best potential to defer or negate future capital and operational expenditure;
- > Generally consistent with the Option 1A strategy outlined in LWA Task: 90-11-19;
- > Relatively larger capacity promotes deferral of the regional Cedar Grove STP;
- > Redundant infrastructure is minimised and reuse opportunities are maximised to ensure maximum service life;
- > Best operational flexibility with infrastructure maintained in service for longer term;
- > Opportunity to decommission Flagstone STP and negate the associated operational costs;
- > Opportunity to stage Riverbend/Gittens treatment capacity and defer up to \$3M of expenditure;
- > Service is provided to ultimate populations of Flagstone North without the need for future augmentations;

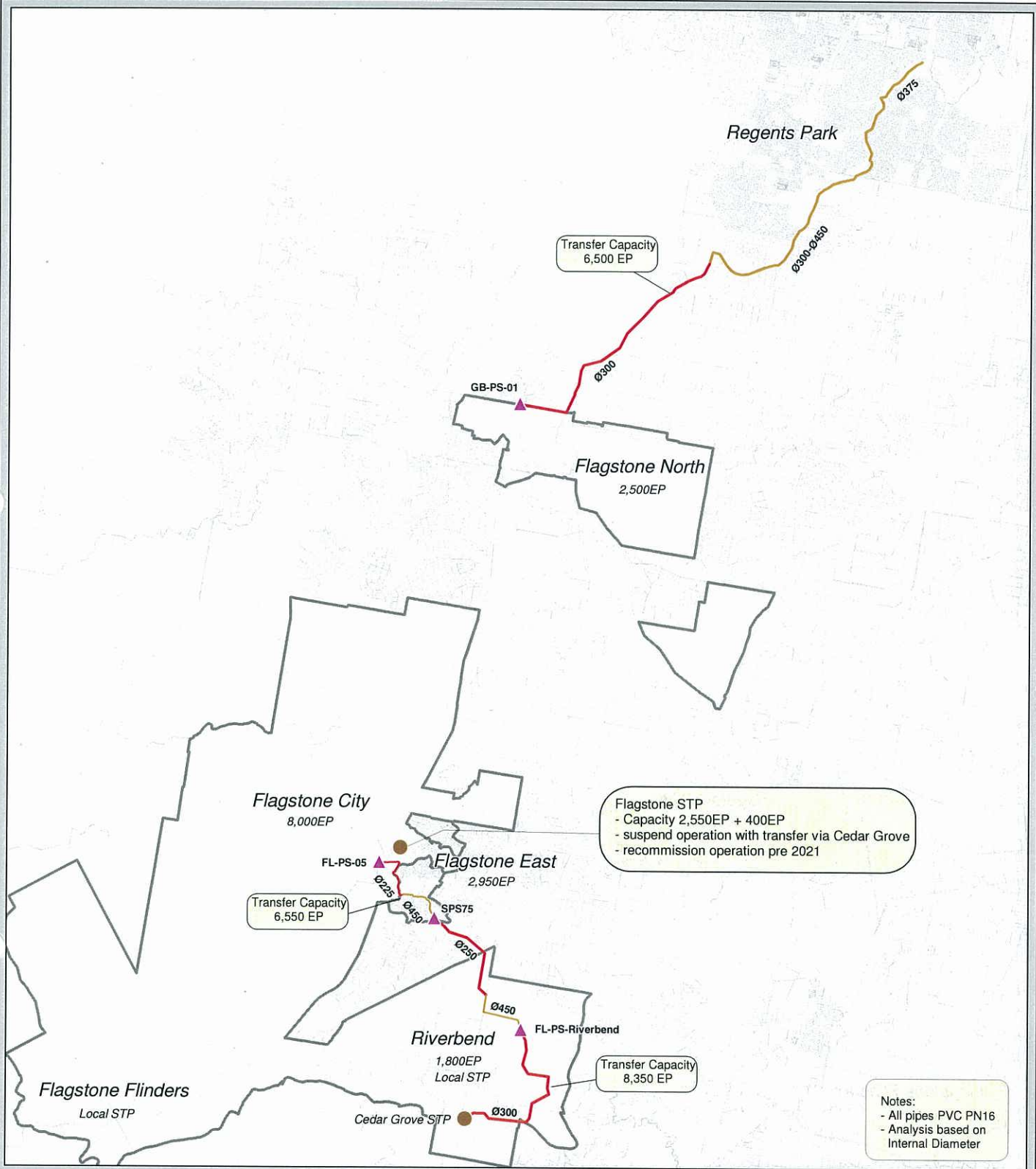
FIGURES

Figure 1 Option CG1

Figure 2 Option CG2

Figure 3 Option FN1

Figure 4 Option FN1



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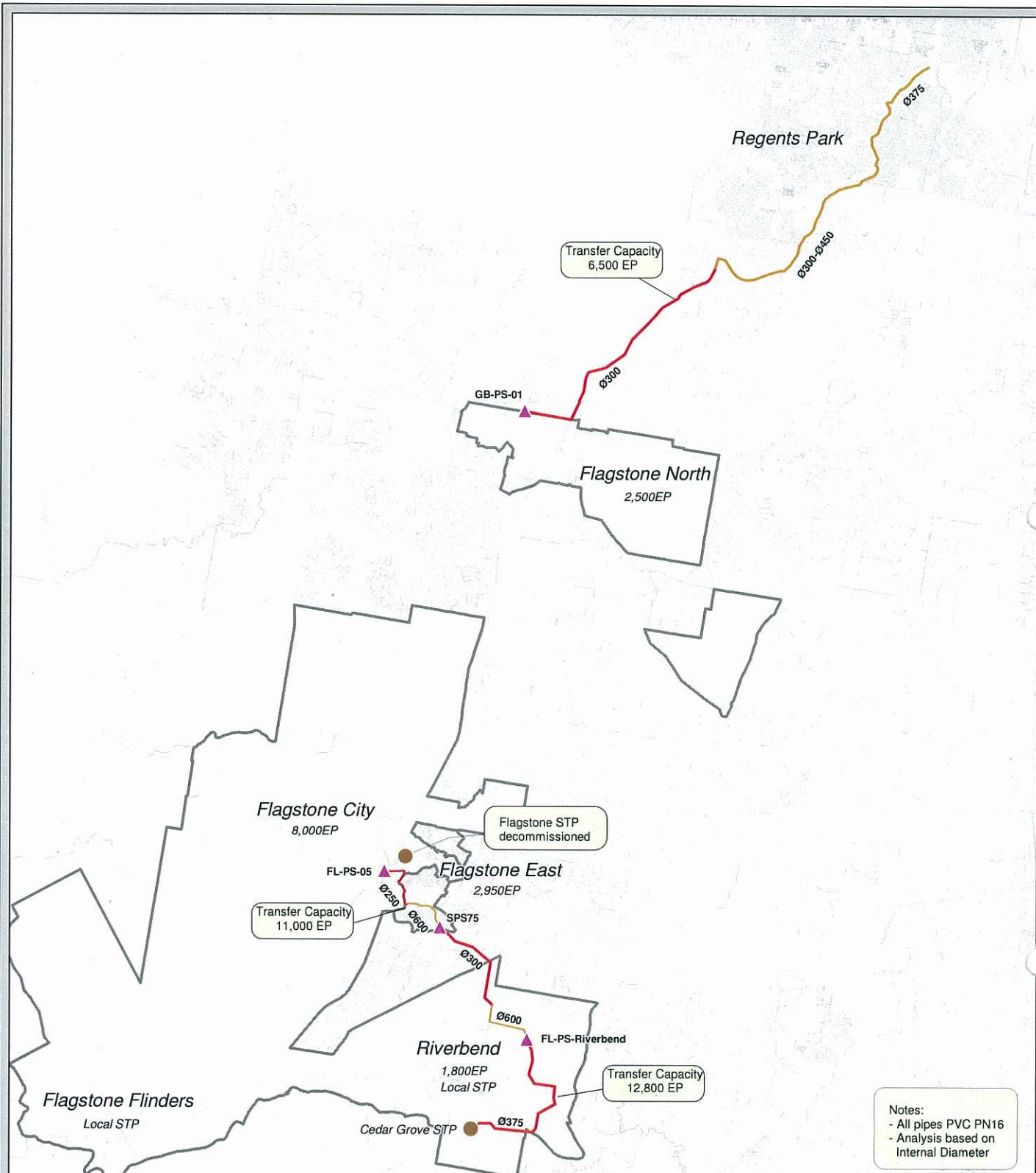
- ▲ SPS
- Sewer Treatment Plant
- Gravity Main
- Rising Main
- ULDA Boundary



Figure 1
Flagstone UDA Sewerage
Short-Medium Term Works
Option CG1

Scale: 1:70,000





Notes:
 - All pipes PVC PN16
 - Analysis based on Internal Diameter



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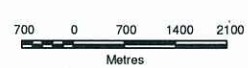
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- ▲ SPS
- Sewer Treatment Plant
- Gravity Main
- Rising Main
- ULDA Boundary

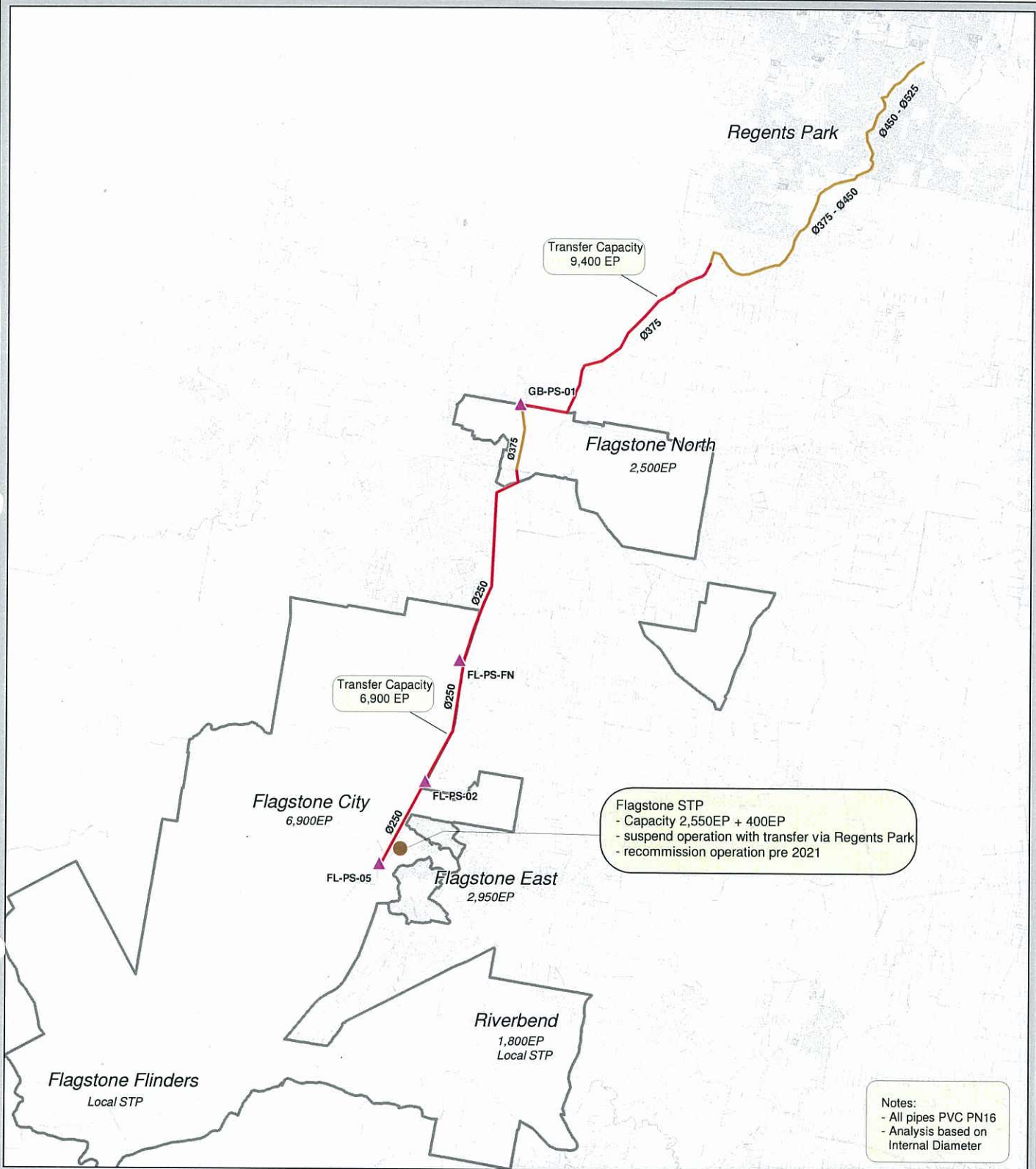


Figure 2
Flagstone UDA Sewerage
Short-Medium Term Works
Option CG2

Scale: 1:70,000



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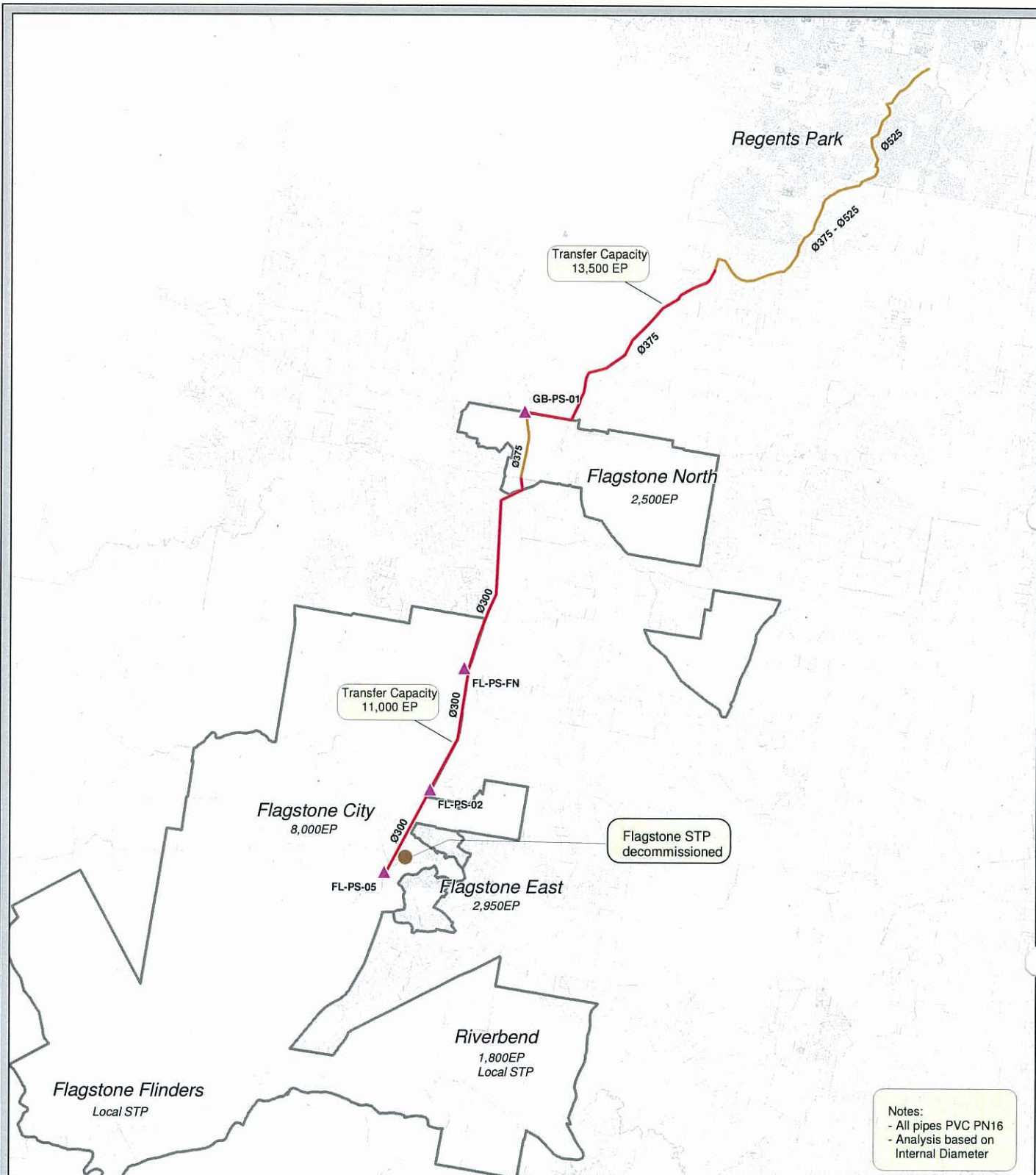


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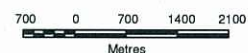
- ▲ SPS
- Sewer Treatment Plant
- Gravity Main
- Rising Main
- ULDA Boundary



Figure 4

**Flagstone UDA Sewerage
Short-Medium Term Works
Option FN2**

Scale: 1:70,000



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Flagstone City
Sewerage Servicing Strategy

APPENDIX

A

Infrastructure Cost Schedules

Cedar Grove Diversion Options CG1 and CG2
Transfer to Cedar Grove STP in the short term

Option CG1				
Service capacity to Flagstone City and Flagstone East local area: 9100EP (6550EP + Flagstone STP 2,550EP) Riverbend/Gittens 1,800EP				
Retain (and suspend) Flagstone STP for future use pre 2020/21				
	Unit Cost	Units	Cost \$k	
FSTP to Cedar Grove STP (Capacity 6550EP)	FL-PS-05 225RM 450GM	<100kW 0.7 0.75	\$540.1 \$238.0 \$685.4	
	SPS78 250RM 450GM	<100kW 2 1.1	\$540.1 \$703.8 \$1,005.3	
	FL-PS-Riverbend 300RM River Crossing	<150kW 3.7	\$702.2 \$1,836.7 \$1,000.0	
				\$6,711.4
Cedar Grove STP				
	Treatment Irrigation	8350 8350	\$12,520.0 \$2,505.0	
				\$15,025.0
Teviot to Regents Park (Capacity 6,500EP)				
	GB-PS-01 300RM 300GM	<100kW 4.9 1.5	\$540.1 \$2,432.4 \$951.9	
	Greenbank to Regents Park (4.0km)	375GM 450GM	\$1,292.0 \$822.5	
	Augment Existing Trunk Sewer (2.9km)	375GM 2.9	\$2,341.8	
				\$8,380.6
				\$30,117

Option CG2				
Service capacity to Flagstone City and Flagstone East local area: 11,000EP (2,950EP East + 8,050EP City) Capacity Riverbend/Gittens 1,800EP				
Decommission Flagstone STP in 2013/14				
	Unit Cost	Units	Cost \$k	
FSTP to Cedar Grove STP (Capacity 11000EP)	FL-PS-05 250RM 600GM	<150kW 0.7 0.75	\$702.2 \$246.3 \$946.2	
	SPS78 300RM 600GM	<150kW 2 1.1	\$702.2 \$992.8 \$1,387.8	
	FL-PS-Riverbend 375RM River Crossing	<250kW 3.7	\$1,003.4 \$2,635.5 \$1,000.0	
				\$8,914.2
Cedar Grove STP				
	Treatment Irrigation	12800 12800	\$19,192.3 \$3,840.0	
				\$23,032.3
Teviot to Regents Park (Capacity 6,500EP)				
	GB-PS-01 300RM 300GM	<100kW 4.9 1.5	\$540.1 \$2,432.4 \$951.9	
	Greenbank to Regents Park (4.0km)	375GM 450GM	\$1,292.0 \$822.5	
	Augment Existing Trunk Sewer (2.9km)	375GM 2.9	\$2,341.8	
				\$8,380.6
				\$40,327

Flagstone North Diversion Options FN1 and FN2
Transfer to Loganholme STP in the short term

Option FN1				
Service capacity to Flagstone City and Flagstone East local area: 9,450EP (6,900EP + Flagstone STP 2,550EP)				
Riverbend/Gittens 1,800EP				
Retain (and suspend) Flagstone STP for future use pre 2020/21				
FSTP to Teviot (Capacity 6,900EP)	FL-PS-05	Unit Cost	Units	Cost \$k
	250RM	\$352	<100kW	\$540.1
	FL-PS-02			\$633.4
	250RM	\$352	<150kW	\$702.2
	FL-PS-FN			\$844.6
250RM	FL-PS-FN		<150kW	\$702.2
	250RM	\$352	3.9	\$1,372.4
	375GM	\$808	1.5	\$1,211.3
				\$5,465.9
Teviot to Regents Park (Capacity 9,400EP)				
Greenbank to Regents Park (4.0km)	GB-PS-01	Unit Cost	Units	Cost \$k
	375RM	\$712	<150kW	\$702.2
	375GM	\$808	4.9	\$3,490.3
	450GM	\$914	2.3	\$1,857.3
	525GM	\$1,081	0.9	\$822.5
Augment Existing Trunk Sewer (2.9km)	525GM	\$1,081	0.8	\$864.9
	450GM	\$914	1.5	\$1,370.9
	525GM	\$1,081	1.4	\$1,513.5
				\$10,621.5
Riverbend STP				
Treatment Irrigation		\$1,499	1800	\$2,698.9
		\$300	1800	\$540.0
				\$3,238.9
				\$19,326

Option FN2				
Service capacity to Flagstone City and Flagstone East local areas: 11,000EP (2,950EP East + 8,050EP City)				
Service Capacity Riverbend/Gittens 1,800EP				
Decommission Flagstone STP in 2013/14				
FSTP to Teviot (Capacity 11,000EP)	FL-PS-05	Unit Cost	Units	Cost \$k
	300RM	\$496	<150kW	\$702.2
	FL-PS-02			\$893.5
	300RM	\$496	<215kW	\$899.8
	FL-PS-FN			\$1,191.4
300RM	FL-PS-FN		<215kW	\$899.8
	300RM	\$496	3.9	\$1,936.0
	375GM	\$808	1.5	\$1,211.3
				\$7,031.7
Teviot to Regents Park (Capacity 13,500EP)				
Greenbank to Regents Park (4.0km)	GB-PS-01	Unit Cost	Units	Cost \$k
	375RM	\$712	<250kW	\$1,003.4
	375GM	\$808	4.9	\$3,490.3
	450GM	\$914	1.4	\$1,130.5
	525GM	\$1,081	1.4	\$1,279.5
Augment Existing Trunk Sewer (2.9km)	525GM	\$1,081	1.2	\$1,297.3
	450GM	\$914	2.9	\$3,135.2
	525GM	\$1,081	2.9	\$3,135.2
				\$11,336.2
Riverbend STP				
Treatment Irrigation		\$1,499	1800	\$2,698.9
		\$300	1800	\$540.0
				\$3,238.9
				\$21,607

