Gore District Council

Emergency Pumping Infrastructure at The Cooper Well Field
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1 Introduction

This report identifies a more reliable emergency pumping system at the Coopers Wells field to serve Gore in times of drought. It has been prepared as part of the overall water supply strategy for Gore. The report provides Gore District Council (GDC) with an outline design for the most suitable emergency pumping solution.

2 Background

During drought conditions the water supplied to the Gore District consumers has been restricted because the available supply cannot meet the demand.

During these times the Gore District Council (GDC) has pumped water from the Mataura River directly into the empty/disused shallow wells at both Jacobstown and Coopers to keep the wellfields operating (used well discharge in an unconfined aquifer). This has been done under the existing Emergency Pumping Consent which allows GDC to take the following volumes from the River Mataura:

- Jacobstown emergency take volume of 900 m$^3$/day at a rate not exceeding 10 litres/second.
- Coopers emergency take volume of 2,851 m$^3$/day at a rate not exceeding 33 litres/second.

Low river flow conditions are likely to occur in the future. Based on the “Hydrology of the Mataura River” Report¹, the water levels of the Mataura River over the last ten years have been characterised by lower than average flow conditions. This period coincides with a dramatic increase in the abstraction of water for irrigation.

In addition, water from the Jacobstown wellfield has had issues with levels of manganese, resulting in consumer complaints. During times of drought the problem increases, leading to the conclusion that the manganese problem is confined to water from the deep well. The current water treatment plants do not have a treatment process for removing the manganese.

Emergency pumping from the river could be used more frequently to avoid the need to take water from depth at the Jacobstown well field. As the Coopers wellfield has the higher allowable emergency take this will be expected to provide most of the demand.

The Coopers Wellfield, located in the centre of a working farm, does not have permanent pumping infrastructure in place. Instead a flexible hose is run from the well down to the river and the water is driven into the well by a tractor driven pump. The set-up is shown in Figure 1 and 2.

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¹ “Hydrology of the Mataura River: A constraint on water abstraction at Gore”, Opus International Consultants, July 2012
Figure 1 Existing Emergency Pump Route

Figure 2 Photos of Current temporary pumping systems
Based on Gore District Council records, the above existing emergency pumping method at Coopers can only provide a flow of 23 litres/sec, which is 70% of the maximum consented rate. For the reasons given above emergency pumping will be required to work at the maximum consented level. Permanent emergency pumping infrastructure will therefore be desirable.

3 Site Constraints

3.1 Topography

Several spot levels were taken along the existing emergency pump route by Opus (September 2013) and shown in Figure 3 below. An arbitrary benchmark level of 100m was assumed at the location of the existing wells.

Figure 3 Survey Spot Heights (September 2013)

Ground levels gradually fall from the wells towards the Mataura River; the highest levels are at over 100m at the northern end of the route and the lowest levels are along the bank of the River varying from 97.9m to 98.5m. At the farms southern boundary there is a steep slope, with a drop of 1.8m, to the top of the river flat.

3.2 River Flows

The Coopers wells are located on the Mataura River eastern floodplain, as shown in Figure 4.
Due to the size of the Mataura River catchment the flows in the river are highly variable; varying from a low of 8m$^3$/s to a maximum recorded flood flow of 2,297m$^3$/s.

Between April and September 2013 flows of the Mataura River were recorded to vary between 68.8 m$^3$/s and 72.0 m$^3$/s. During this period the Environmental Southland river gauge at Gore recorded a water level difference of 0.4m. As the river width at the Coopers site is approximately the same as at Gore then the level height difference at the gauge can be applied to Coopers.
Based on the Environmental Southland river gauge data for the last 10 years (Graph 1 above), it appears that the water level can vary by approximately 3.5m. Based on the levels in Figure, there is a 0.5-1.0m difference between the existing water level and the location the existing emergency pump is placed, which indicates that there could be as much as 2m deep flood water passing over this area.

The southern Coopers farm fence line is 2.5m above the water level at the time of the survey, which is 0.3m above the normal water level (as defined by Environmental Southland). From this fence line to the Coopers wells the land is effectively flat. Based on Graph 1 the highest recorded level in Gore is 3.3m above the normal water level, therefore the land between the Coopers farm southern boundary and the wells could have up to approximately 1m deep flood water.

The high flows will cause the loose gravel banks along the river to shift, resulting in the constant alteration to the cross sectional shape of the river. In addition to high flows during a flood there is a significant amount of debris brought down to Gore, as evident at the bridge downstream.

There is a natural narrowing of the river channel to the west and south east of Cooper’s wells, therefore compared to the wider river channel south west of the wells, these will have a significantly high velocity. Areas of high velocity should, where possible, be avoided as there is a greater risk of equipment being damaged and sediment entering any suction point.

The current suction point has slow flow. In addition, the existing natural rock in the river (Figure 5).

![Natural Rock in River](image)

Figure 5 Location of potential water section point and Natural Rock in River (Photo taken 19.Sep.2013)

### 3.3 Land Access

As mentioned in Section 2 of this Report this site is a working (dairy) farm, and whilst GDC have the rights to access part of the land, they ensure that the landowner is consulted on access and where possible compromise is made to ensure there is minimal disruption to the farm.
GDC have the rights to access and place any infrastructure within the area highlighted (Figure 6) which is Original River Bed, Figure 7.

![GDC Rights to Access Area](image1.png)

**Figure 6 GDC Rights to Access Area**

The most direct route from Coopers Wells to the Mataura River crosses the centre of a paddock which is outside of the GDC rights to access. This may also limit the farmer’s use of this land.

The existing temporary emergency pump route (Figure 1) which followed the existing path and paddock boundaries is mostly within the GDC rights to access the area and ensured that there was minimal disruption to the farm. Permanent infrastructure along this route would allow any buried pipeline or power cable to be found easily.

![Original River Bed](image2.png)

**Figure 7 Original River Bed (Photo taken 19.Sep.2013)**
3.4 Power Supply

There is currently a three phase electrical power supply to the equipment at Coopers Well Field. The maintenance electrician thinks that ‘the system at the pumping station maybe close to capacity’. However GDC own a transformer at the site which could possibly be upgraded to provide the source of power for the emergency pump. At the time of this report discussions were on-going.

Due to the site being a working farm, and within the floodplain, any electrical wires will need to either suspended above the height of any farm equipment and any debris being carried by the floodwater or buried in protective casing along a route which could be easily identified (i.e. at the paddock boundary).

The alternative to an electrical power supply is the use of a diesel engine/generator. However these pose potential environmental risks and should be avoided, if at all possible. The favourable electricity tariff for GDC is also a factor in the preference for electricity.

4 Pump Requirements

The new pump and pipelines will be designed to ensure they can provide the maximum consented volume of 2,851 m$^3$/day at a rate not exceeding 33 litres per second.

A flow meter will be positioned at the well field end of the pipeline to ensure compliance with Environment Southland’s requirements.

5 Pump Station Options

5.1 Completely Permanent Infrastructure

This option involves having permanent infrastructure from the River to Coopers Wells, as shown in Figure 8. The route follows existing farm roads and tracks to avoid future disturbance from farming activities.

The advantage of having a fully permanent system is that it can be operated remotely, without any disruption to the farm.

The main disadvantage stems from the varying flood flows. As mentioned in Section 3 of this report during high flow events the banks can shift, changing the shape of the river which in turn could result in the suction point not being submerged during low flows. Also the infrastructure could get damaged during a flood event and depending on the extent of the damage it could be out of commission for the following summer.

The frequency and rate of flood flow in the main channel are such that contingency funds would need to be included in this option for replacement of the emergency pumping station and pipeline in the river at least once during the equipment’s operational timeline.
5.2 Mainly Permanent Infrastructure

This option involves having mainly permanent infrastructure from the River to Coopers Wells, as shown in Figure 9 below. It is proposed that the pipeline and electrical power supply between the wells and the river bank would be constructed as permanent features. In the vulnerable river flat area, where the movable pump would be positioned, temporary pipework and electrical cabling would be used.

As mentioned above there can be variations to the cross-sectional area of the river channel therefore the emergency pumping equipment between the Coopers farm southern hedge line and the water has not been fixed, giving GDC flexibility to select the optimum suction point during each drought period. Installation of a T-junction at the end of the permanent pipeline would allow the addition of future pipe branches along the fence line for even greater flexibility.

At the end of each drought period the emergency pumping equipment can be taken off the river flat to a safe storage area. Based on the current deployment of the temporary pump at Coopers, this system can be assembled or dismantled in couple of hours. By having the pipeline fixed between the existing wells and the edge of the farmland, there is again minimal disruption to the farmer and his stock.
This option involves having temporary infrastructure from the River to Coopers Wells, as per the existing arrangement (Figure 10).

This option is a complete upgrade of the existing temporary emergency pump system at Coopers which will allow it to pump water at the maximum consented rate.

This option has the advantage of no permanent infrastructure maintenance work and the flexibility to use the equipment at other sites along the river.

If this option was used it would cause the most amount of disruption to the working farm as measures would need to be taken to ensure no farm equipment or stock damaged the lay flat pump line. It is also the most labour intensive option as there would need to be more frequent watch over the equipment to ensure that it operated as required.
Figure 10  Temporary Infrastructure Option Outline Route
6 Discussion

The Mainly Permanent Infrastructure Option has the advantages of a permanent pumping infrastructure for the majority of the system while avoiding the problems on the river flat arising from the highly variable flows in the Mataura River. Experience with the current temporary system has shown that connection of the proposed temporary section should not pose problems and the use of a trailer mounted pump will allow easy removal to safe storage. This option minimises disruption to farm activities and avoids the disadvantages of both the Completely Permanent and Temporary Infrastructure options. The Mainly Permanent Infrastructure Option is therefore the preferred option.

7 Cost Estimates

Based on the current prices (September 2013) an outline budget for the Mainly Permanent Infrastructure Option has been summarised in Table 1 below. This price allows us to provide all items listed in the appendix.

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Permanent Pipeline &amp; Fittings.</td>
<td>$220,000.00</td>
</tr>
<tr>
<td>2</td>
<td>Electrical and Controls System.</td>
<td>$155,000.00</td>
</tr>
<tr>
<td>3</td>
<td>Mobile Pump System including trailer, Flexible hose and all required fittings and valves.</td>
<td>$25,000.00</td>
</tr>
<tr>
<td></td>
<td><strong>Total:</strong></td>
<td><strong>$400,000.00</strong></td>
</tr>
</tbody>
</table>

*Table 1 Outline Cost for Emergency Pump System*

The above price excludes any upgrade of the electrical capacity at the Coopers Well pumping station and also excludes GST.

8 Conclusion

The Mainly Permanent Infrastructure Option is the preferred option for providing a more reliable emergency pumping system at the Coopers Wells field to serve Gore in times of drought. This system can be provided at an estimated cost of $400,000.00 +GST.
Appendix A

Emergency pumping system includes:

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Buried pipe DN200 PVC-O PN12.5, above ground pipe DN200 steel.</td>
</tr>
<tr>
<td>2</td>
<td>Flow meter DN200 Krohne waterflux</td>
</tr>
<tr>
<td>3</td>
<td>Well level monitoring - Endress &amp; Hauser Waterpilot</td>
</tr>
<tr>
<td>4</td>
<td>Pump Goulds GIS 125x100-250/11kw 4 pole Fitted with Sic/sic seal for possible silt loading.</td>
</tr>
<tr>
<td>5</td>
<td>Trailer Pump mounted on Galvanised trailer with fixed axle and brakes Four hand wound stabilisers Rain hood Lights Provision for tool box to be bolted to draw bar Hand prime pump, Suction fittings including Tee strainer with 6mm apertures and 4.5m of flexible suction pipe connected to suction 7m of lay flat using Bauer type ball couplers for discharge connection Pressure gauge and lines.</td>
</tr>
</tbody>
</table>