Who are Rationale?

- Started by Edward Guy in 1999
- Based in Arrowtown
- Staff of 8
- Infrastructure analysis and management
- Wastewater modelling for QLDC since 2003

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Queenstown Wastewater Modelling

The Story So Far

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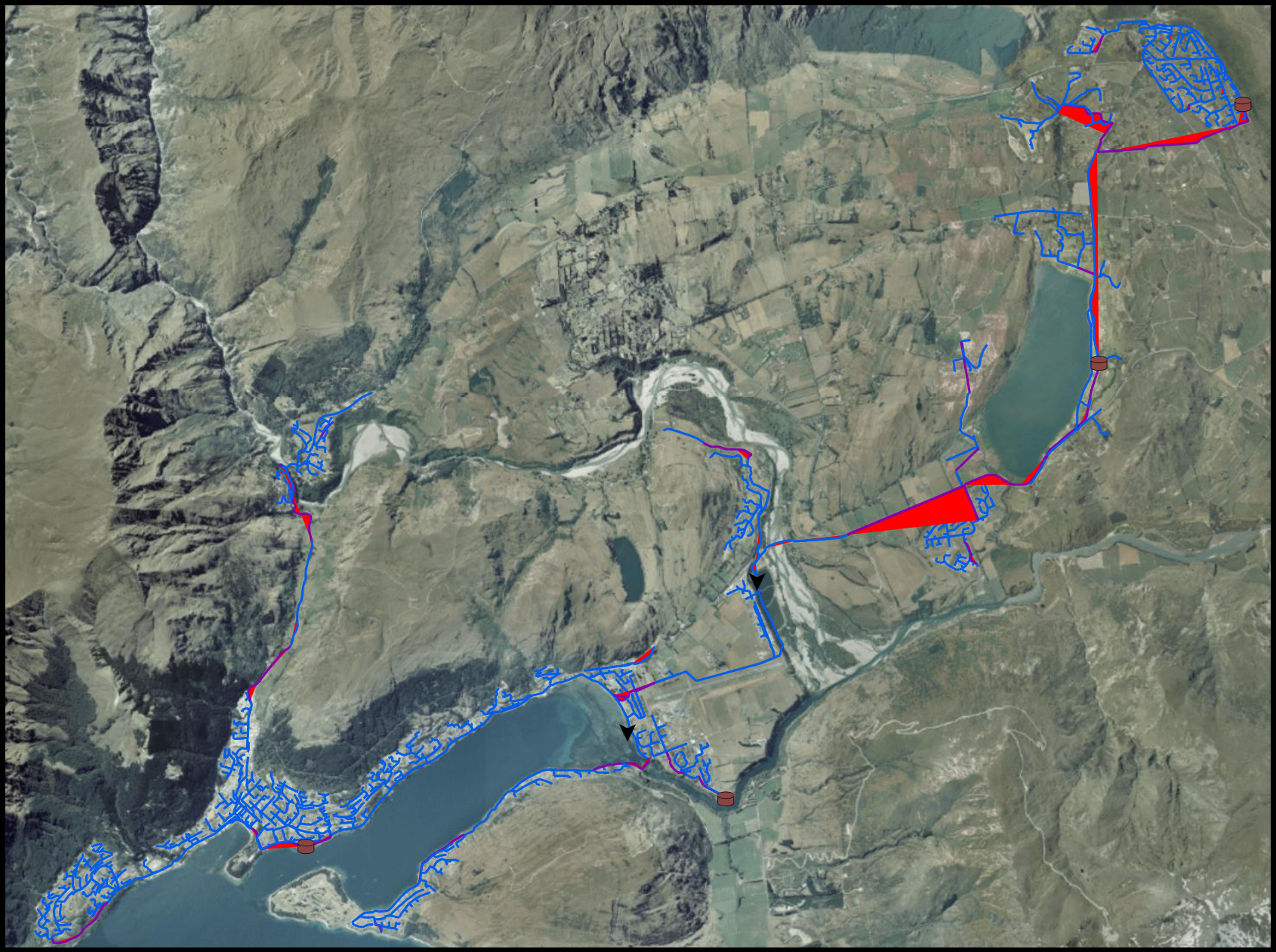

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Queenstown Wastewater Modelling

ISSUE - Large visitor Population

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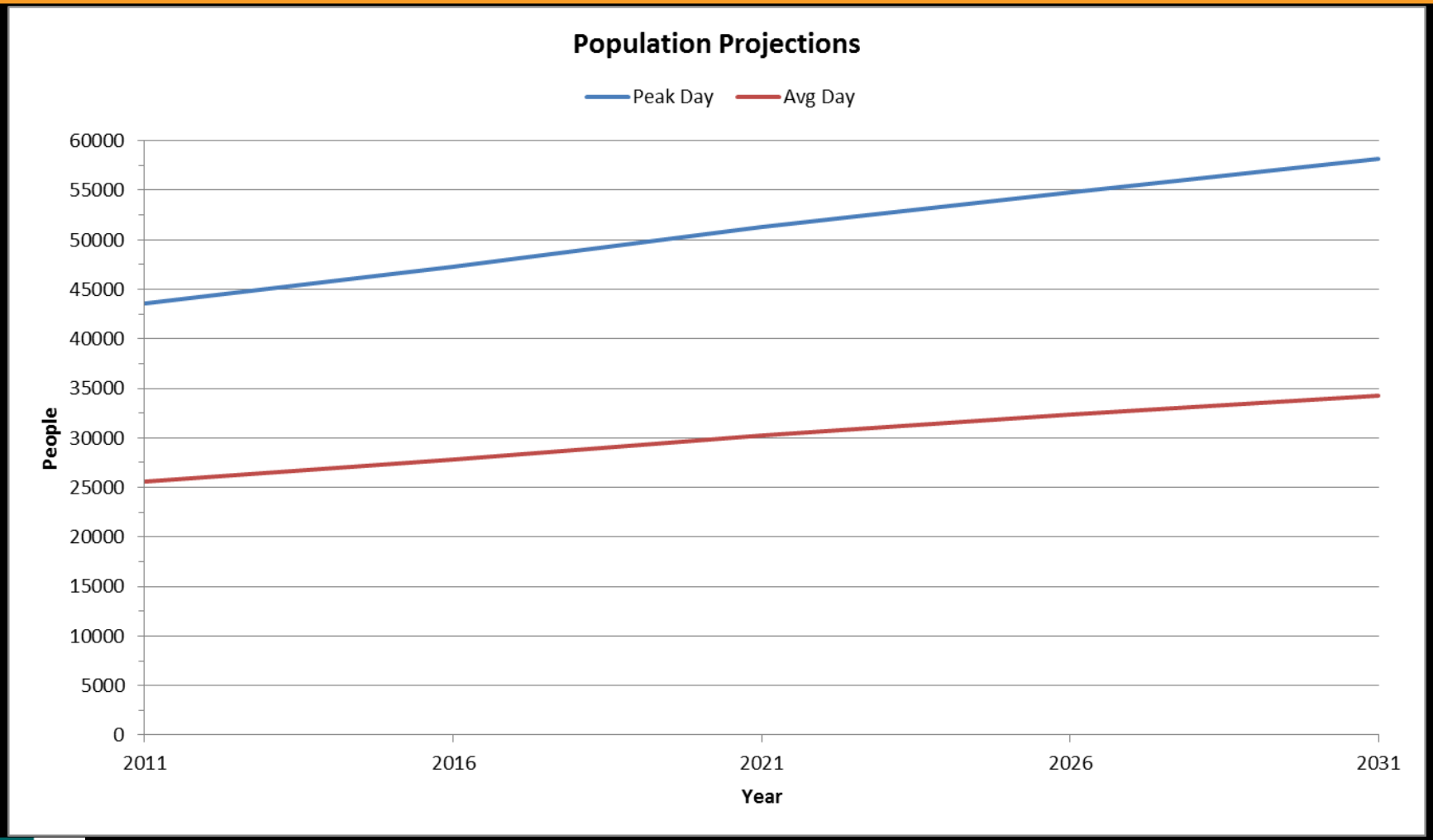
ISSUE - Large population growth



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ISSUE - Fluctuating lake level

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ISSUE – Lack of Redundancy in Key Assets (High Risk Consequence)

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ISSUE - Environmentally, socially and economically sensitive areas.

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Queenstown Wastewater Modelling
History

2003 – Main Drivers to Start Modelling

- Limited asset management planning
- No formal forward works programme
- Little understanding of capacity constraints

2004 - Solution

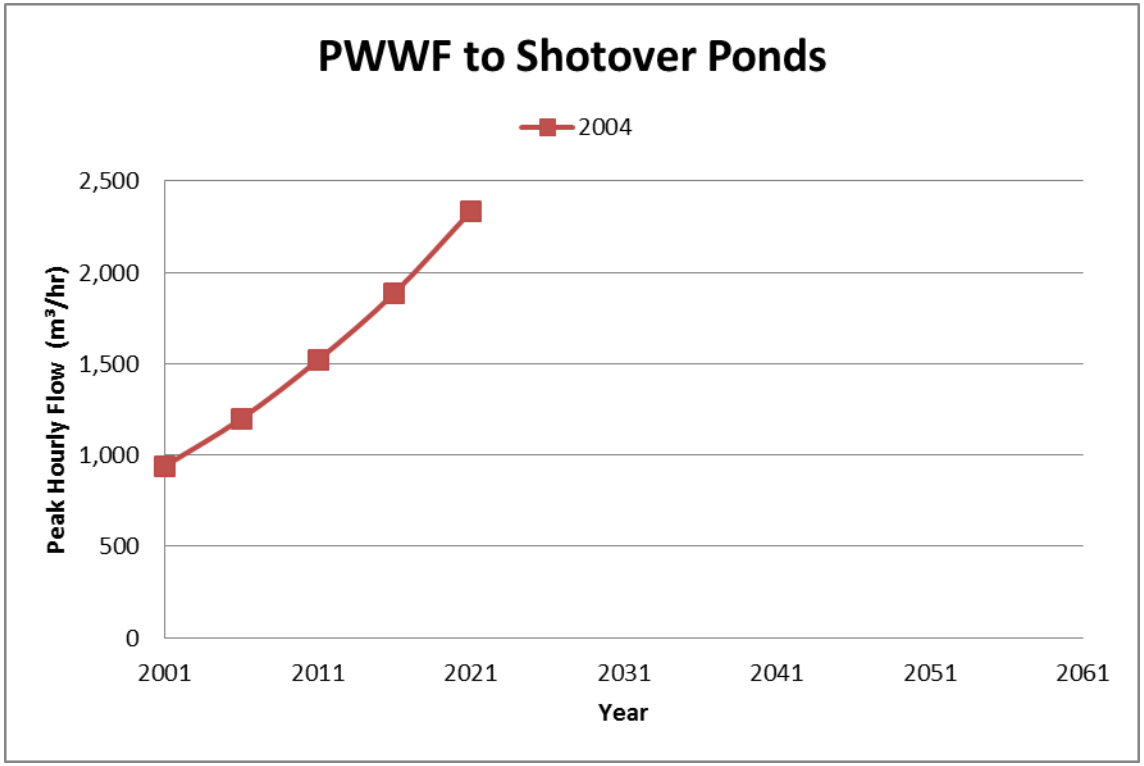
- Static trunk main model developed in SewerCAD
- Based on assumed occupancy, generation rates and peaking factors

Issues / Improvements

- Big holes in GIS data
- Very limited and unreliable flow data

Queenstown Wastewater Modelling
History

2004 – Results



Queenstown Wastewater Modelling
History

2005 - Solution

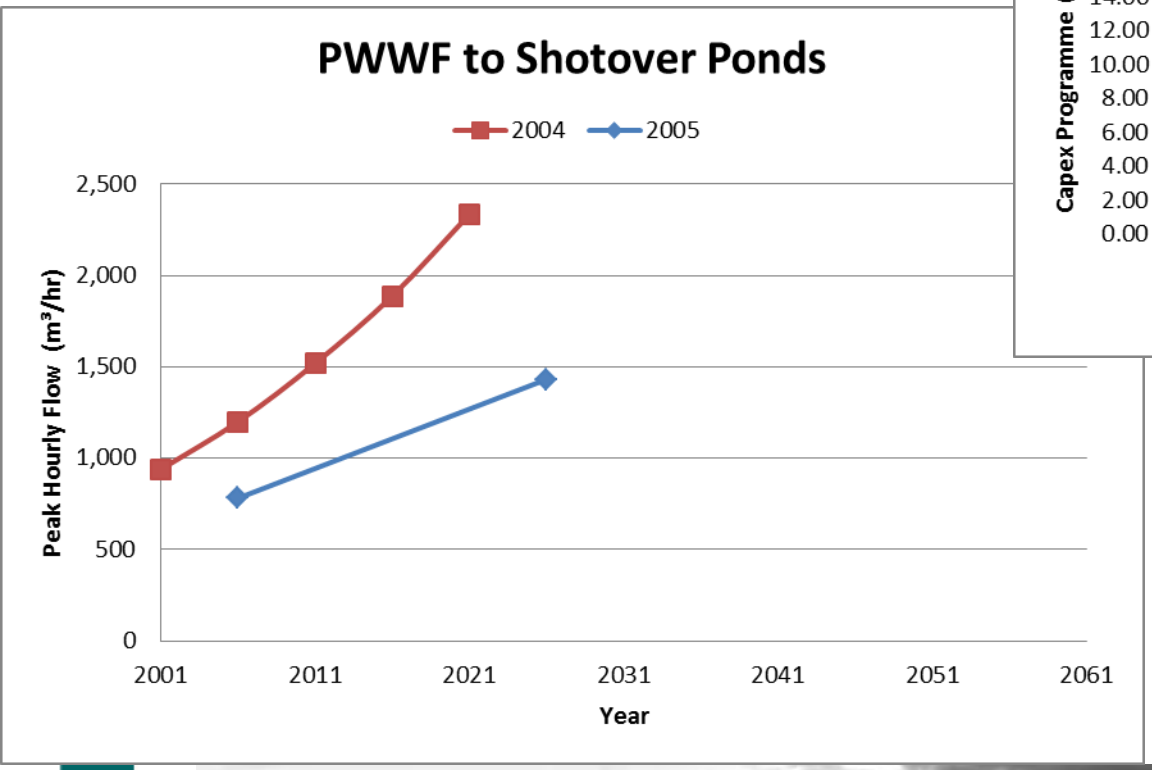
- Improved GIS data allowed development of network models
- Based on QLDC's amendments to NZS 4404 generation rates and peaking factors

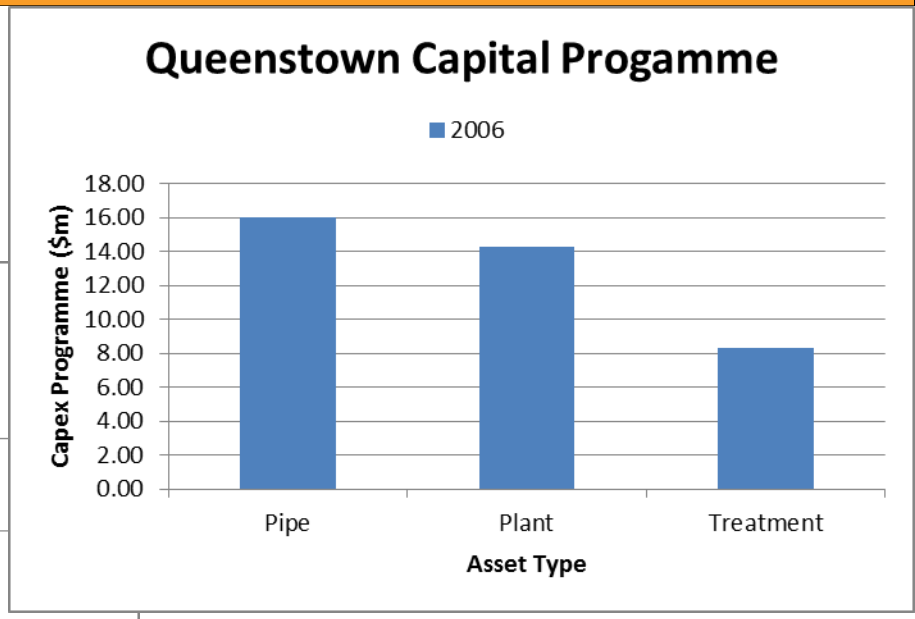
Issues / Improvements

- Still requiring measured flows
- Peak population still not understood fully

Queenstown Wastewater Modelling
History

2005 – Results (2006 LTCCP)





Queenstown Wastewater Modelling
History

2006 - Solution

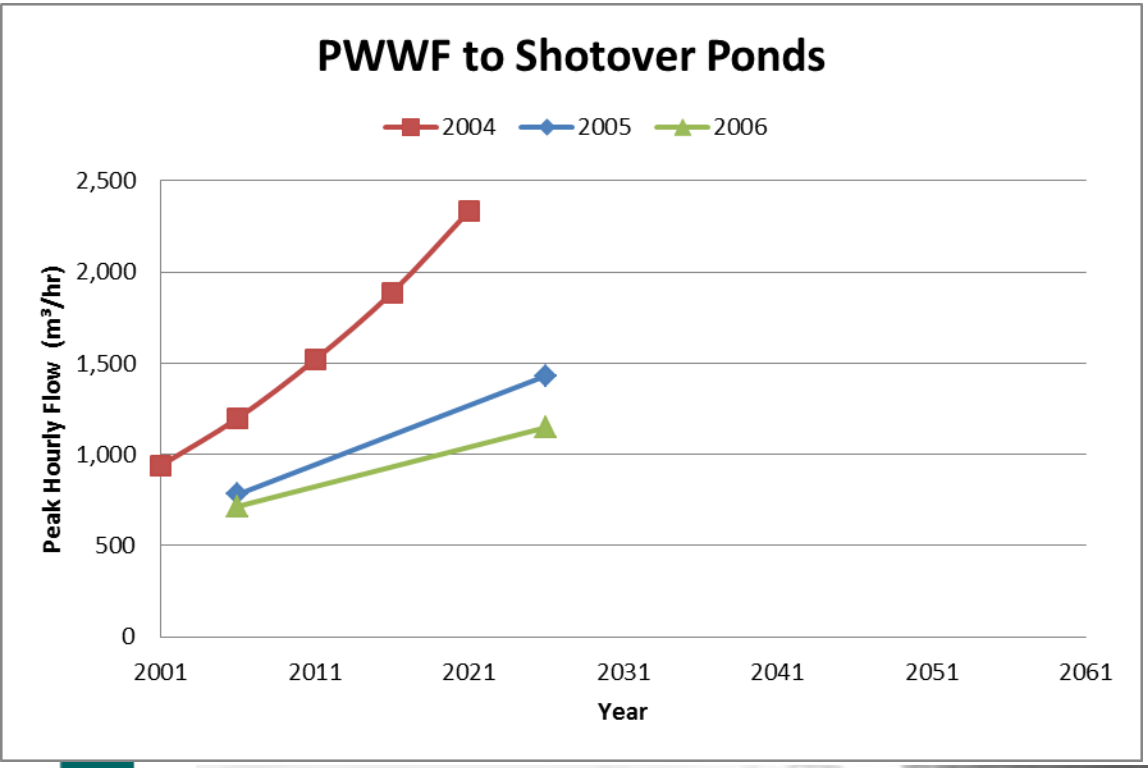
- Based on peak population survey
- Measured generation rates and peaking factors

Issues / Improvements

- Understanding of network dynamics and I&I
- Asset data verification - plant and pipe
- Requirement for detailed flows/capacities for infrastructure design

Queenstown Wastewater Modelling
History

2006 – Results



Queenstown Wastewater Modelling
History

Stage 2007 – Solution

- Dynamic models developed in SewerGEMS
- Calibrated to short term flow survey*
- Significant verification asset data*
- Peak population modelled with 10 year ARI storm
- Storm peak coincides with diurnal peak

Issues / Improvements

- Unexplained data from flow survey
- Model calculation engine stability

** Completed in conjunction with Connell Wagner.*

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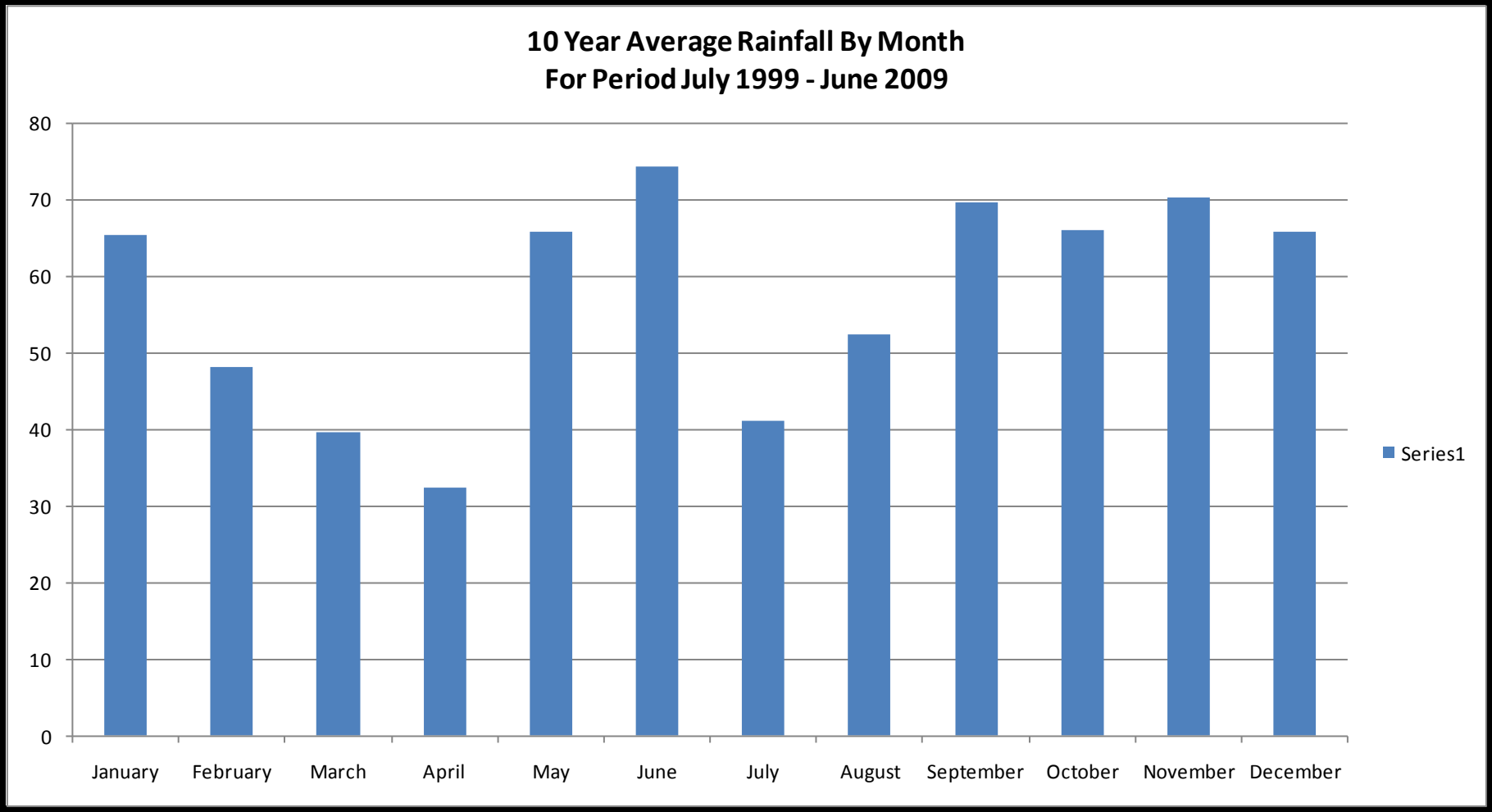
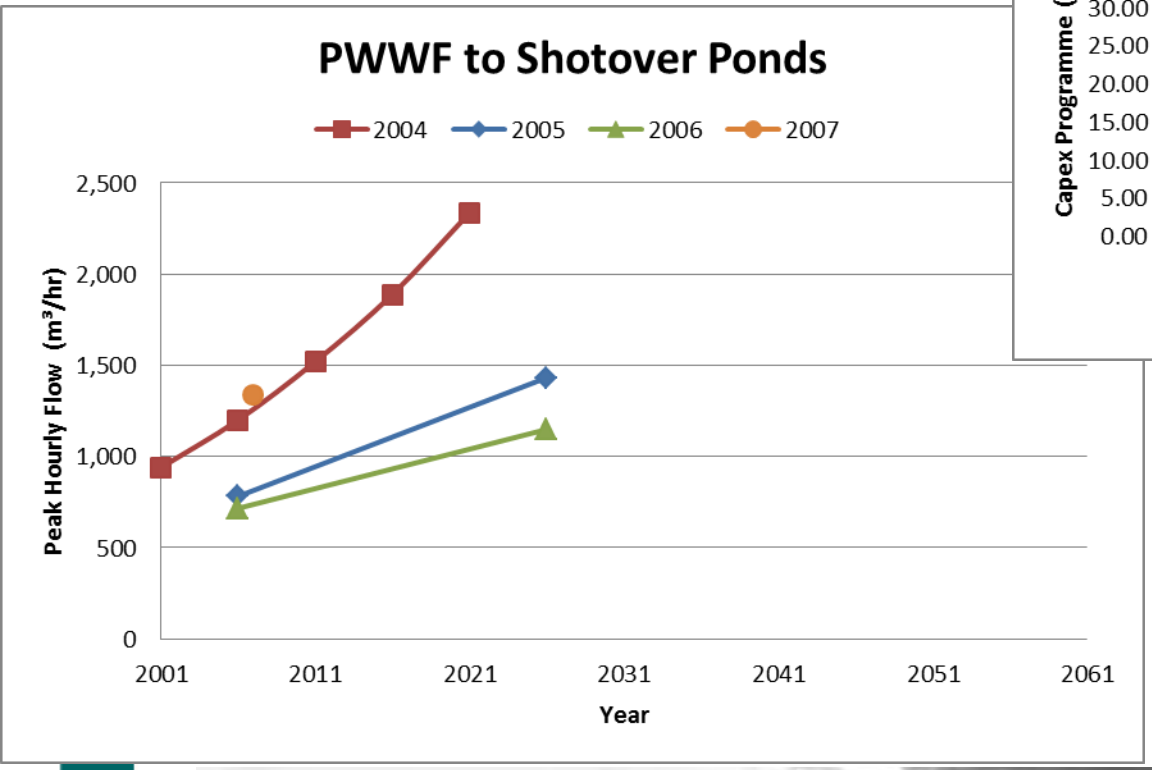
QLDC - Project Shotover Flow Projections

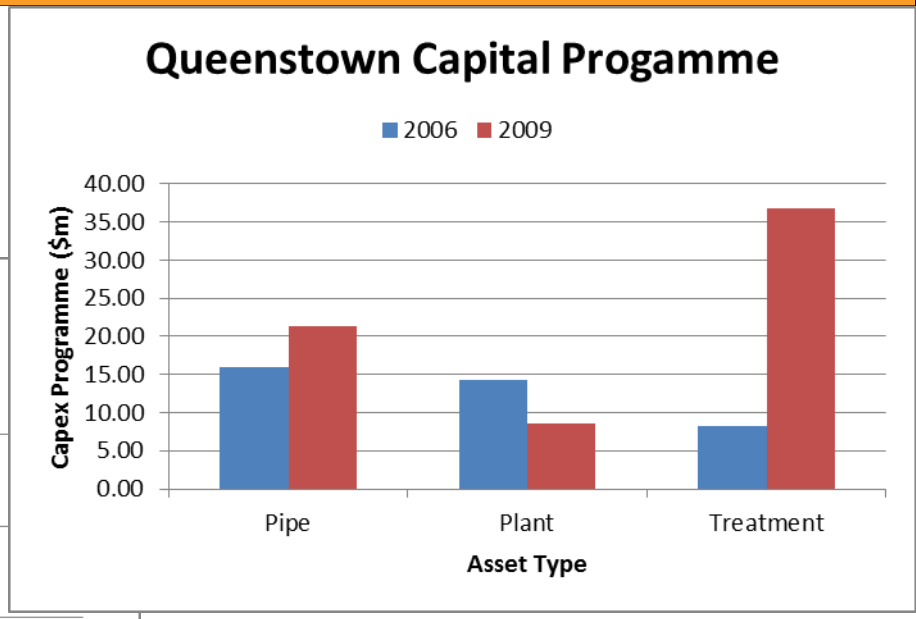
Wet Weather Effect – Historical Rain Data



Queenstown Wastewater Modelling
History

2007 – Results (2009-19 LTCCP)





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Queenstown Wastewater Modelling
History

2010 – Solution

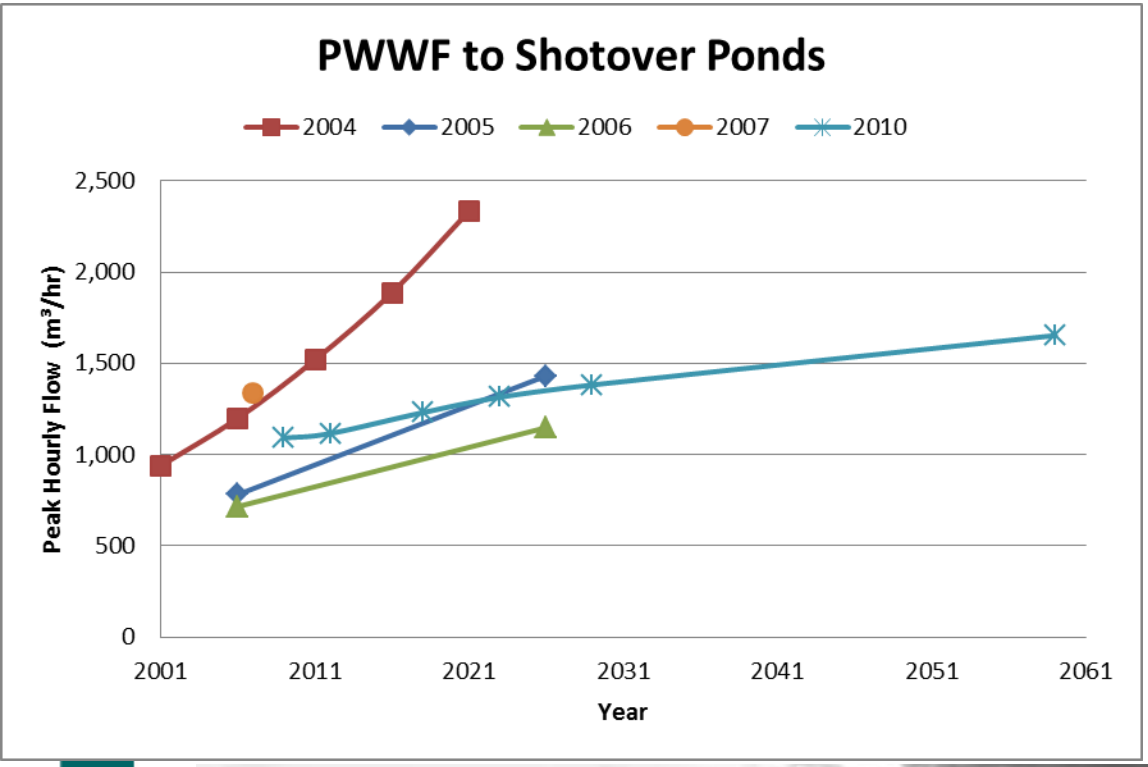
- Flow Projections for Project Shotover
- Dynamic models recalibrated to new flow survey and SCADA
- Consideration of lake level influence added
- 24 hour storm introduced (large storm calibration)

Improvement Plan:

- Effect of high lake levels
- Optimisation of existing network

Queenstown Wastewater Modelling
History

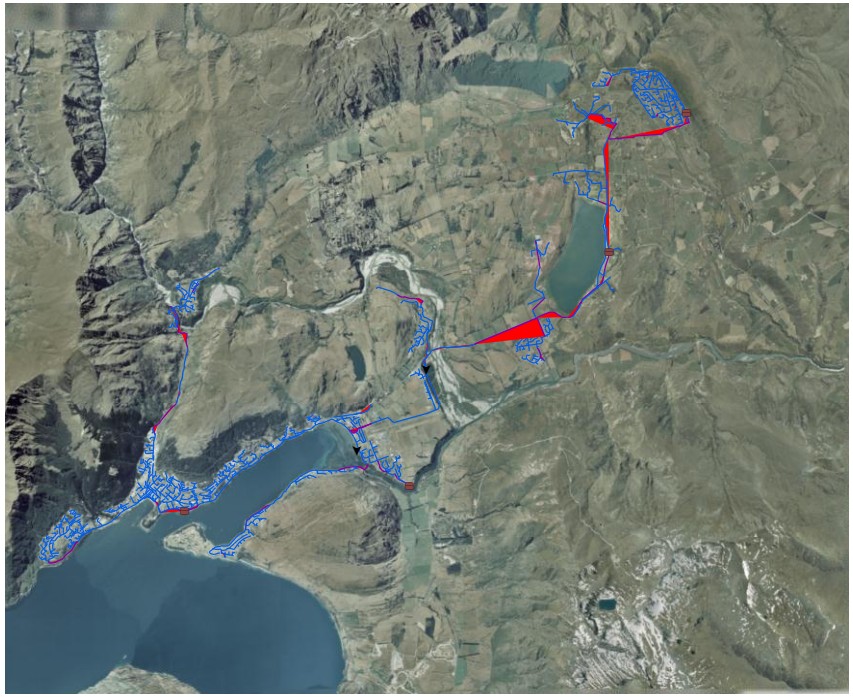
2010 – Results



Queenstown Wastewater Modelling
History

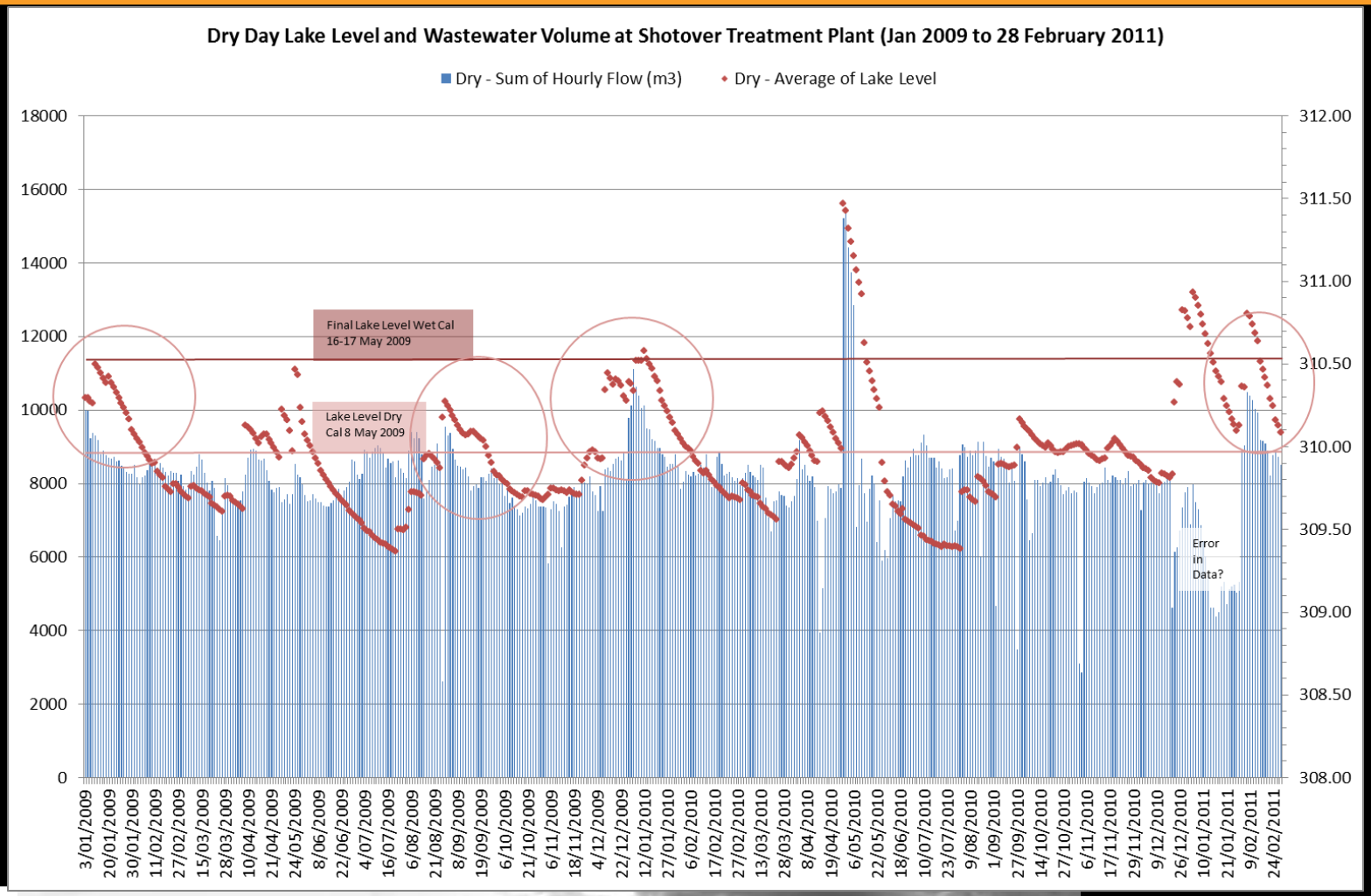
2012 Solution

- Converted to Mike Urban
- Dynamic models recalibrated to SCADA data
- Lake level knowledge improved / 24 hour storm calibration revised
- Revised approach to dealing peak flow



Queenstown Wastewater Modelling

Lake Level Influence / Seasonal Flow



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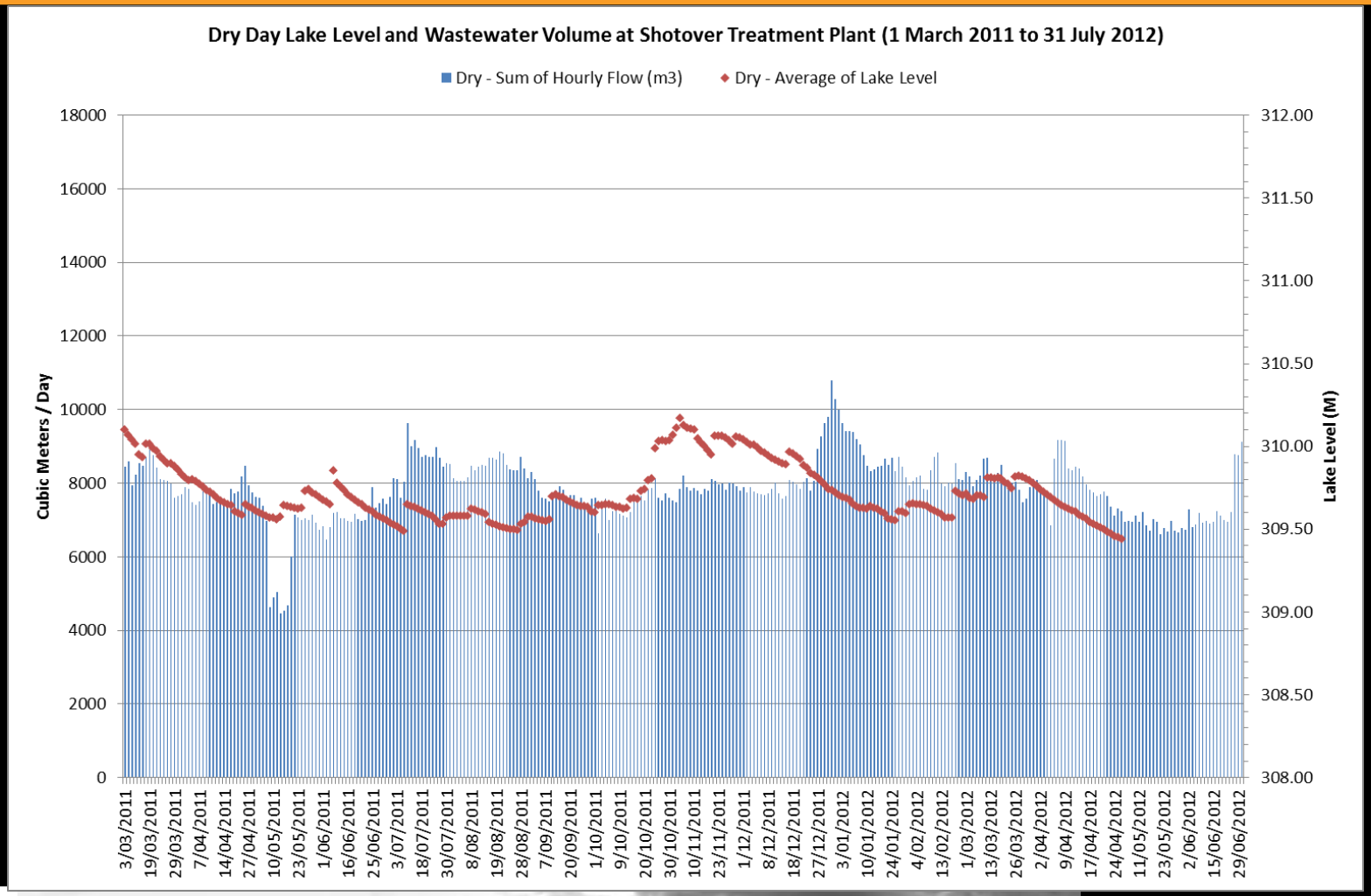
Queenstown Wastewater Modelling

Lake Level Influence / Seasonal Flow



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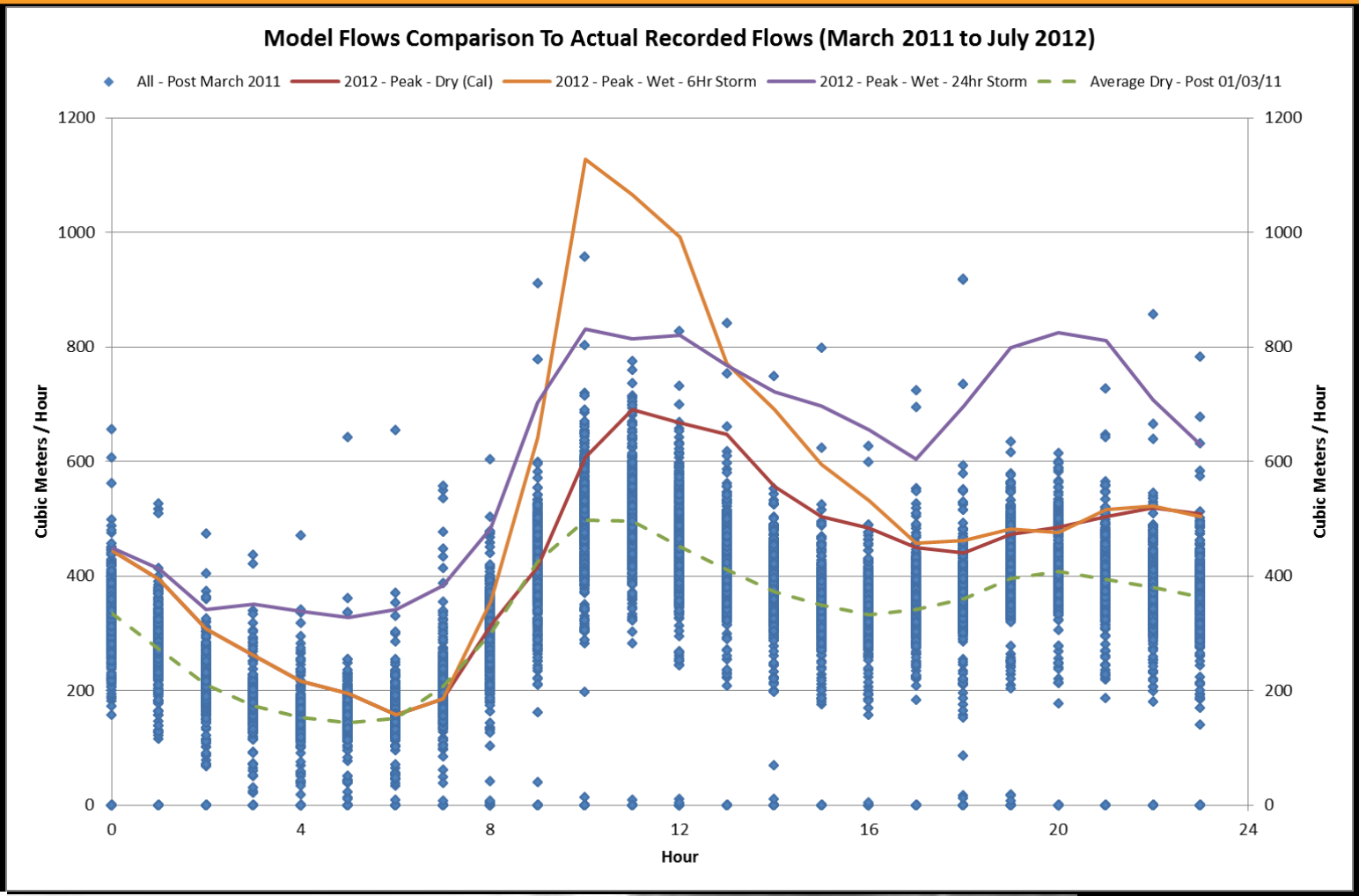
Queenstown Wastewater Modelling

Latest Calibration and Design Scenarios



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Use of Existing Potential Storage

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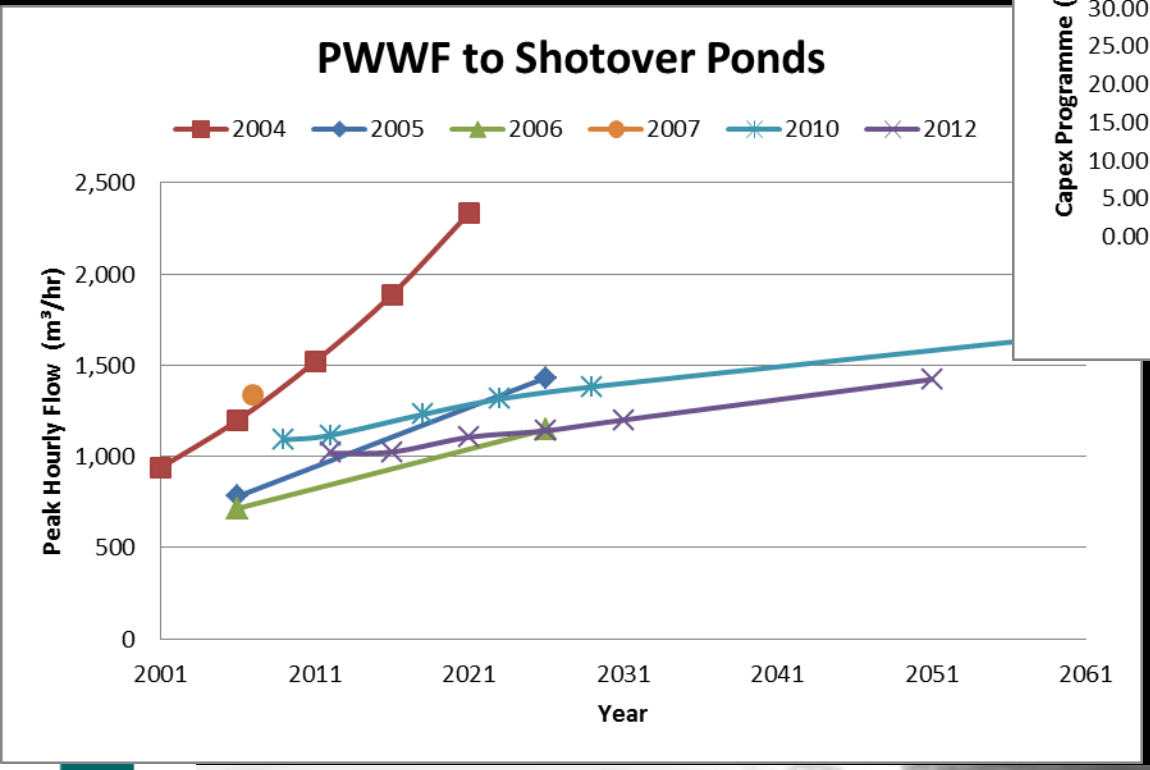
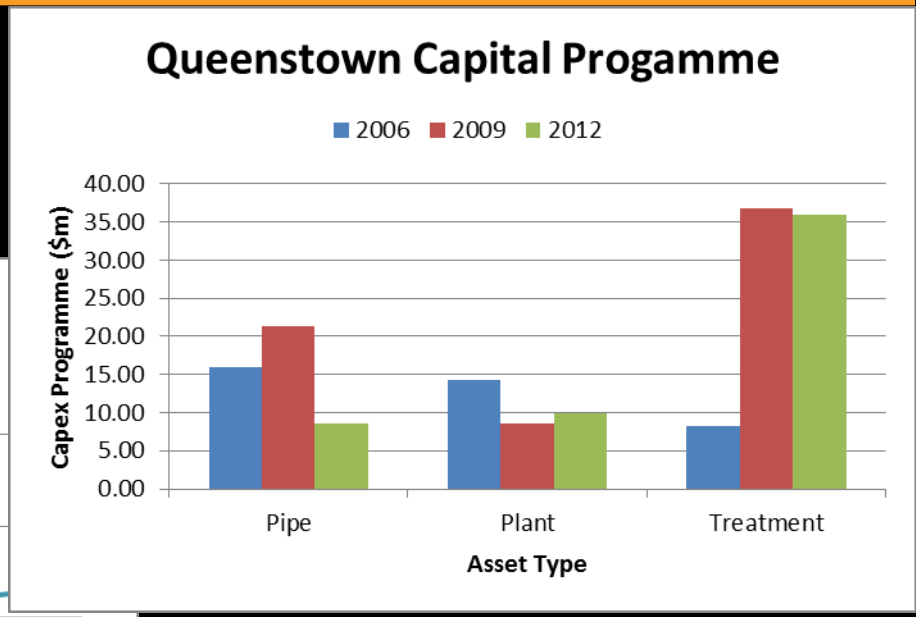
History of flow Projections





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Queenstown Wastewater Modelling
What's Next?

QLDC 3 Waters Strategy (2011)

Decision Making Framework

1. Identify the Problem and the Key Driver → 2. Consider a full range of options → 3. Consider the timing → 4. Prioritise

Queenstown Wastewater Modelling
What's Next?

1. Identify the Problem and the Key Driver (Capacity, Condition, Performance, Risk Management)
   - Identify network capacity constraints (master planning)
   - Quantify lake level influence with higher confidence
2. Consider a full range of options
   - Master planning exercises (working with developers for large greenfield sites)
   - Consideration/modelling of operational and life cycle costs
3. Consider the timing
   - Consideration/modelling of operational effects / staging that could defer capital projects
4. Prioritise
   - Risk based justification for projects (risk cost) and develop unique LOS for some assets

Queenstown Wastewater Modelling

What's Next?

Queenstown Lakes District Council
Project Shotover Flow Projections - Risk Register

2/10/2012

Risk / Issue	Risk Description	Consequence		Likelihood		Score		Mitigation				
		Consequence	Rating	Description	Rating	Score	Description	Current Treatment	Status	Action	Responsibility	Completed
LTP Capital Programme	Risk of capital programme not going ahead, causing the model results to be invalid.	Medium	40	Quite Common	4	160	High	Used latest LTP programme. Rec Ground Pump Station is key assumption in peak flow results.	Action required	Possible sensitivity study, TBC in March 2013	Rationale	
Large rainfall event	Model is not calibrated to a large rainfall event. Calibration to event of 5 year ARI or greater would be beneficial.	Medium	40	Unlikely	3	120	High	Model is calibrated to largest storm event in recent times. Approx. 2 year ARI, or 63% of volume of 10 year event.	Action required	Monitor rainfall data for possible event and add to projections in March 2013 if data availalbe	Rationale	
Lake Level Infiltration	Model assumes relatively low infiltration due to lake level. Another lake level even may demonstrate that significant infiltration still exists.	Medium	40	Unlikely	3	120	High	Assumes recent work significantly mitigated impact of high lake level.	Acceptable	Requires on going monitoring and remedial works.	QLDC	
Missing SCADA data	Marine parade still has inoperable flow meter	Medium	40	Unlikely	3	120	High	Flow and operating data taken from GHD report and O&M manual	Action required	GE to look at getting new flow meter installed	QLDC	
Intermittent SCADA data	Frankton Beach PS had intermittent flow data on 1 rising main and recorded volumes significantly higher than TP inlet.	Medium	40	Unlikely	3	120	High	Used pump flows supplied by Veolia and pump run data from complete data on smaller rising main. Not calibrated for volume.	Completed	Has been fixed since peak period		2/10/2012
Scheme Boundary Changes	Some areas outside of current scheme boundary have been added, however, other large users could potentially connect	Medium	40	Unlikely	3	120	High	Known potential development (Shotover Country, AT South, Jopp St) has been included. Other potential areas outside of scheme boundaries can be considered on a case by case basis.	Acceptable			2/10/2012
Population Projections	Flow projections and LTP Capex programme both based on current population projections. Significant variation from these may impact on both.	Medium	40	Unlikely	3	120	High	Used latest population projections, possibly still a conservative approach.	Acceptable	Used latest data - review again if projections change		
ARI & Duration of Design Storms	Should more than two design storms be used? What about a longer storm or long time series model run?	Medium	40	Unlikely	3	120	High	Use of 6hr and 24 hr storms considered to give good overall results. 10 year ARI previously agreed LOS - could be reviewed.	Action required	Define LOS for QLDC WW and consider updating in March 2013	Rationale/MH	
Rainfall Pattern	Rainfall patterns. 6 hour storm is theoretical (high initial intensity then reducing), 24 hour based on real storm.	Medium	40	Unlikely	3	120	High	Mix of 'real' storm and high intensity 6 hour storm considered relatively conservative	Action required	Define LOS for QLDC WW and consider updating in March 2013	Rationale/MH	
Ground Water and Rainfall I&I	Deterioration of network causing significant increases in I&I.	Medium	40	Unlikely	3	120	High	No change in I&I parameters - should be conservative as construction techniques and renewals programmes improve	Acceptable	Requires on going monitoring and development of robust renewals programme	QLDC	
Critical Design Criteria	Are suitable parameters being used for accurately designing the proposed treatment system?	Major	70	Rare	1	70	High	Peak flows and daily volumes considered acceptable for sizing of treatment plant. Other parameters available if required.	Acceptable	Level of data and accuracy believed to be sufficient for this purpose		
Inaccuracy of SCADA data	Poor accuracy level of SCADA, resulting in poor calibration	Minor	10	Quite Common	4	40	Moderate	Differences to previous models calibrated to flow survey have been reviewed and considered acceptable.	Acceptable	Level of data and accuracy believed to be sufficient for this purpose		
Localised rainfall	Currently reliant on 1 rain gauge at airport. Localised rainfall, especially in hilly areas, is potentially different.	Minor	10	Quite Common	4	40	Moderate	Model calibrates to current available data, effect of hill only significant for catchment level modelling	Acceptable	Level of data and accuracy believed to be sufficient for this purpose		
Nature of SCADA data	Relying on SCADA, pump station outlet data results in inaccurate ground water I&I calibration	Minor	10	Quite Common	4	40	Moderate	Ground water I&I is relatively low contributor to wastewater volumes except for lake level. Levels in current model comparable to previous models.	Acceptable	Level of data and accuracy believed to be sufficient for this purpose		
Inaccurate GIS data	Significant missing data and confidence levels in GIS data.	Minor	10	Quite Common	4	40	Moderate	Model calibrates well fro strategic level model, inaccuracies only significant for catchment level modelling	Action required	On-going improvements being made.	Rationale / RC	
Climate Change	Climate change previously proven to not cause significantly more I&I. Although, council now have directive to model climate change. Has Climate change projections changed significantly?	Minor	10	Unlikely	3	30	Moderate	Previously modelled and not deemed a significant effect	Action required	Define LOS for QLDC WW and consider updating in March 2013	Rationale/MH	
Winter Day	Previous modelling demonstrated that winter flows only 9% above average day. However, ski field flows divert significant flows from Shotover Treatment Plant.	Minor	10	Unlikely	3	30	Moderate	Previously modelled and not deemed significant, can be completed as a desktop exercise if required	Acceptable			
Demand reduction	No demand reduction has been assumed, is this appropriate considering the move towards water efficient technology.	Minor	10	Unlikely	3	30	Moderate	No demand reduction assumed - Conservative approach	Acceptable			
Timing of rainfall event	Is modelling design storms on the peak day/hour the correct scenario to model?	Minor	10	Unlikely	3	30	Moderate	Peak Population and Peak Rainfall assumed to coincide - Conservative approach	Action required	Define LOS for QLDC WW and consider updating in March 2013	Rationale/MH	

Projections Risk Register.xlsx

Risk Register

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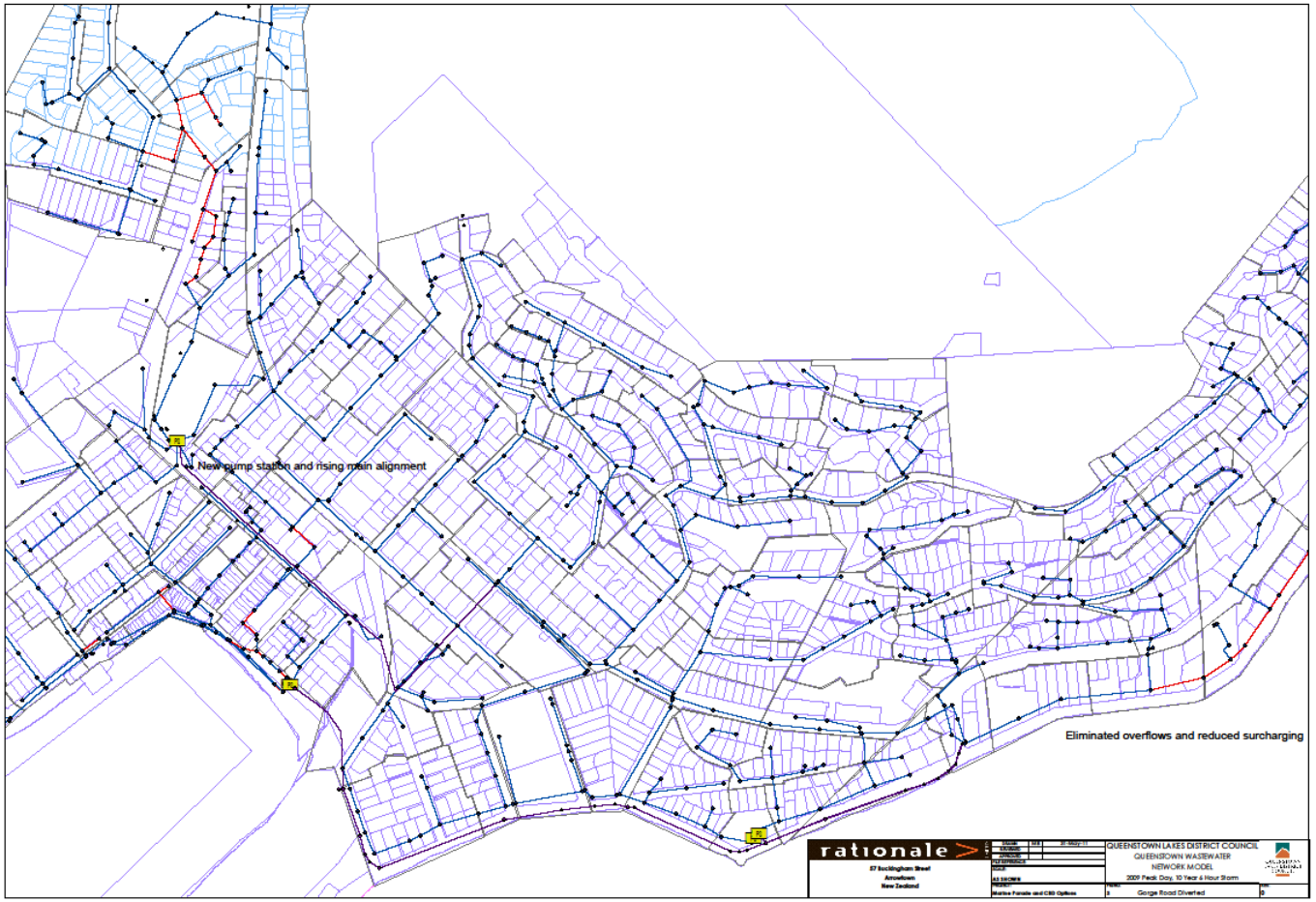
Queenstown Wastewater Modelling

What's Next?



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What's Next?

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BCR Template
Project Priority Tool

Direct benefits and costs
Can be readily quantified and attributed to the organization. Examples of direct benefits include:
- Maintenance improvements - the asset will be better maintained
- Reduction in repair costs
- Operating improvements - the asset will operate more effectively, or will provide better service.
- Revenue generation

ProjectID:
Project Name: Marine Parade
Discount Rate: 10%
Timeframe (yrs): 20

			2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31
		Year:	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
		Discount:	1.00	0.91	0.83	0.75	0.68	0.62	0.56	0.51	0.47	0.42	0.39	0.35	0.32	0.29	0.26	0.24	0.22	0.20	0.18	0.16	0.15
Costs	Investment Costs (-ve)																						
	Costs associated with project only.	*Sunshine Bay & Arthurs Point storage*			-120,000																		
		Flowmeter replacement			-18,000																		
		Provide additional storage (Park St)				-10,000	-100,000																
		Additional pump station - Stg1							-100,000	-2,900,000													
		Additional pump station - Stg2									-10,000				-3,000,000								
	TOTAL	-6,258,000	-	-	- 138,000	- 10,000	- 100,000	-	- 100,000	- 2,900,000	- 10,000	-	-	-	- 3,000,000	-	-	-	-	-	-	-
	PV TOTAL	-2,695,028	-	-	- 114,050	- 7,513	- 68,301	-	- 56,447	- 1,488,159	- 4,665	-	-	-	- 955,892	-	-	-	-	-	-	-
	Annual Costs (-ve)																						
	Costs measured against the status quo.	*I&I reduction*						-10,000	-10,000	-10,000	-10,000	-10,000	-10,000	-10,000	-10,000	-10,000	-10,000	-10,000	-10,000	-10,000	-10,000	-10,000	-10,000
		Rising main investigation			-5,000																		
		Modelling investigations			-20,000																		
	TOTAL	-185,000	-	-	- 25,000	-	-	- 10,000	- 10,000	- 10,000	- 10,000	- 10,000	- 10,000	- 10,000	- 10,000	- 10,000	- 10,000	- 10,000	- 10,000	- 10,000	- 10,000	- 10,000	- 10,000
	PV TOTAL	-74,098	-	-	- 20,661	-	-	- 6,209	- 5,645	- 3,132	- 4,665	- 4,241	- 3,835	- 3,505	- 3,186	- 2,897	- 2,633	- 2,394	- 2,176	- 1,978	- 1,799	- 1,635	- 1,486
Benefits	Annual Benefits (+ve)																						
	All benefits are measured against the status quo.	*Defer CBD to Frankton project*	694,438		8,734,101										-9,068,539								
		Remove Marine Parade Storage project		225,000	375,161																		
	TOTAL	960,161	694,438	225,000	9,109,262	-	-	-	-	-	-	-	-	-	- 9,068,539	-	-	-	-	-	-	-	-
	PV TOTAL	5,537,783	694,438	204,545	7,528,316	-	-	-	-	-	-	-	-	-	- 2,889,516	-	-	-	-	-	-	-	-

PV of Net Benefits	2,768,657
Benefit Cost Ratio	2.0

Page 1 of 1

Prepared for Queenstown Lakes District Council
By Rationale Ltd

File: Marine Pde - NPV analysis v2.xlsx
Date: 30/05/2011

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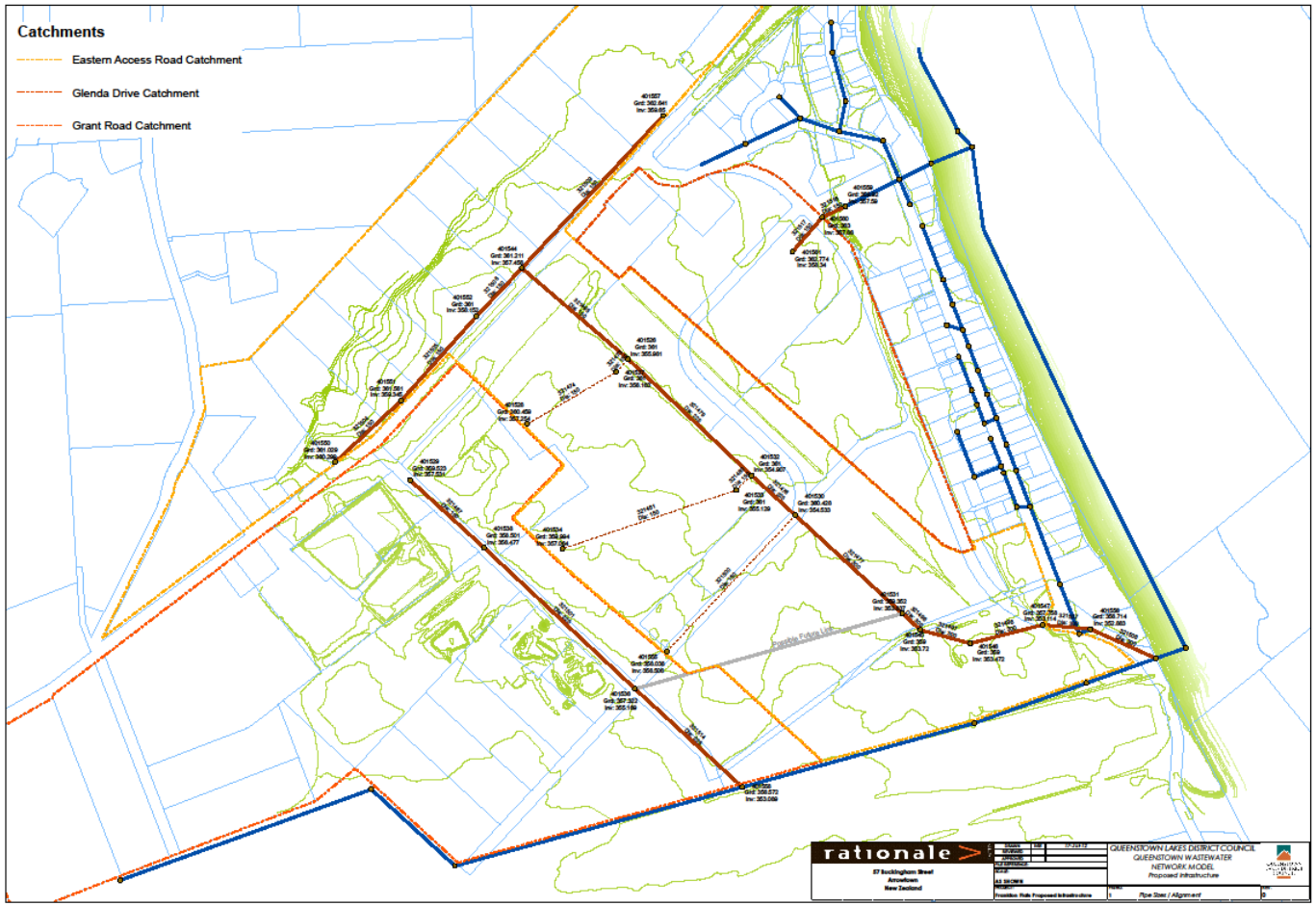

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