

at Foxton's Land Treatment System

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Environmental

Climate Extremes



Data: WWW Votual Climate Statute Network (WCSW). Anomalies are calculated with reference to a 1991-2020 climate/lags, Summer refers to the meteorological season which rure from December-Fahruary.











Climate Extremes

Rain

More frequent and extreme wet weather implications

- Increased wastewater volumes from I&I
- Increased rain capture by the ponds
- Increased pressure on storage capacity
- Increased need for wet season discharges
- Reduced ability for pasture to be irrigated





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Drought More frequent and extreme drought implications

- Reduced wastewater volumes from reduced I&I
- Reduced supply for irrigation (pond evaporation too)
- Unpredictable for storing water in advance



Location







Location







Annual rainfall for 1993-2020 was usually above the long-term average.

1995-96 and 2021-22 had the highest rainfalls.

2021-22 suddenly had extremely high rainfalls.









Average during 1997-2020 was 10 % above the long-term average.

Very few years had 95 % or less of the long-term average.

None of the last 9 years were below long-term average.









Most years had equally wet and dry months. 2021-22 had

frequent months of extremely high rainfall totals.

Highest monthly totals since July 1998, Oct 1998, and Feb 2004.

years (1994, 1995, 2021, and 2022) were 38-50 % above the long-term av

Annual Total Rainfall (mm)

···· Rolling 5-year Average of Annual Rainfall (mm)





Month	Long-Term Average (Range)	2017	2018	2019	2020	2021	2022	2023
Jan	63 (10 – 130)	111 <mark>(2nd)</mark>	55	41	35	67	31	70
Feb	68 (14 – 270)	91	135	45	38	38	230 (2 nd)	98
Mar	52 (20 – 134)	80	71	36	61	113 <mark>(3rd)</mark>	53	60
Apr	55 (21 – 189)	189 <mark>(1st)</mark>	88	82	37	47	42	164 <mark>(2nd)</mark>
Мау	81 (18 – 193)	121	93	78	80	53	160 (2 nd)	151 <mark>(4th)</mark>
Jun	95 (28 – 172)	31	72	97	119	121	155 <mark>(3rd)</mark>	28
July	93 (27 – 240)	98	176	139	80	111	240 <mark>(1st)</mark>	60
Aug	85 (19 – 172)	152 <mark>(3rd)</mark>	86	143	70	172 <mark>(1st)</mark>	158 <mark>(2nd)</mark>	120
Sep	77 (9 – 189)	112	48	33	159 <mark>(2nd)</mark>	112	78	76
Oct	101 (28 – 260)	41	41	91	77	98	58	60
Nov	86 (16 – 192)	16	101	83	132	116	149 (2 nd)	70
Dec	107 (10 – 283)	10	93	90	143 (3 rd)	283 (1 st)	84	86
Whole Year	961 (811 – 1,395)	1,051	1,058	959	1,030	1,330 (4 th)	1,440 <mark>(1st)</mark>	1,042

Large number of extremely wet months during 2021-22.

Many months of top 3 wettest for the last 30 years.

Extremely wet summer months during 2020-22.

> Most months are extremel wet and well above average

and and and and and and and and and

average rainfall t

long Term Average (mm)

tremely wet month

Monthly Total Rainfall (mm)



Wastewater Volumes



Extremely high flows in 2015-17 and 2021-22.

Sudden increase in 2015: storms and reticulation deterioration.

Climate change boost in 2021-22.

Trade wastes also kept increasing.





Wastewater Volumes



Sudden increase occurred in 2015.

Extremely high volumes more often in 2015-17 and 2021-22.

Dry weather flows higher since 2015.

More trade waste, people, and I&I.





Predicted Wastewater Storage Volumes





Actual Wastewater Storage Volumes





Actual Wastewater Storage Volumes





Land Treatment System Irrigation Management Units







MU

1 2

IMU 1

L5 L6 L7 L8

M4







Irrigation Discharge Constraints

Constraint	IMU 1	IMU 2	IMU 3	
Terrain and soil type	Low silty flats 18 ha	Elevated sand plains 37 ha	High sand dune basins 8 ha	
Priority for scheduling	First	Second equal	Second equal	
Application regime	Deficit	Non-deficit (+8 mm)	Non-deficit (+20 mm)	
N load (kg N/ha/y) - Normal - Exceptional Circumstances	175 175	300 400	300 400	
Nitrogen Losses (kg N/ha/y)	34 kg N/ha/y as a 5-year rolling average of Overseer® predictions			



Irrigation Discharge Constraints

Irrigation aims to overcome more extreme drought events that are likely to occur more often and intensely in future.

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Exceptional Circumstances allow irrigation to accommodate more extreme rainfall events that are likely to occur more often and intensely in future.

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Exceptional Circumstances occur when storage is nearly full and normal irrigation criteria are not met due to wet soils or cumulative nitrogen loads.

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N load (kg N/ha/y) - Normal	175	300	300
Exceptional Circumstances	175	400	400



Exceptional Circumstances allow for irrigation of IMU's 2 and 3 up to higher cumulative nitrogen load limits while disregarding soil moisture and rainfall.











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Consent



Consent

Storage

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Extreme volumes did not exceed total available storage capacity





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Future Reticulation needs to be fixed to avoid emergency discharges



Consent

Storage





Exceptional Circumstances irrigation is crucial and effective







Irrigation



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The farm coped with extremely high rainfall and large irrigated volumes





Irrigation

Rainfall



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The farm coped with extremely high rainfall and large irrigated volumes

Manage Integrated management was highly adaptable and successful



Irrigation

Rainfall



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