Table 3-37: High Manning's "n" HEC-RAS model results

Reach	Chainage	Flow	Min Channel Elev.	Water Surface Elev.	Max Channel Depth	Channel Velocity	Flow Area	Top Width
		(m3/s)	(m)	(m)	(m)	(m/s)	(m2)	(m)
2	1500	13.1	93.84	95.01	1.17	1.55	8.46	14.55
2	1450	13.1	89.49	90.86	1.37	1.31	10.02	15.08
2	1400	13.1	82.72	84.04	1.32	2.56	5.13	7.75
2	1350	13.1	76.96	78.82	1.86	1.12	11.71	12.59
2	1300	13.1	74.64	74.82	0.18	1.32	9.89	56.47
2	1250	13.1	67.89	69.68	1.79	0.91	14.39	14.19
2	1200	26.2	67.02	67.58	0.56	1.08	24.34	52.07
2	1150	26.2	60.58	61.66	1.08	2.21	11.87	18.69
2	1100	26.2	48.11	49.82	1.71	2.88	9.09	10.71
2	1050	26.2	41.88	44.20	2.32	1.35	19.46	16.57
2	1000	26.2	39.81	40.25	0.44	1.82	14.40	43.14
2	950	26.2	35.47	37.10	1.63	0.98	26.74	27.38
2	900	26.2	33.87	34.87	1.00	1.49	17.54	32.49
2	850	38.8	24.62	25.84	1.22	2.95	13.15	14.87
2	800	38.8	20.40	22.72	2.32	1.12	34.62	27.44
2	750	38.8	19.26	19.92	0.66	1.89	20.50	56.57
2	700	38.8	16.56	18.38	1.82	0.53	72.75	59.43
2	650	38.8	16.56	18.06	1.50	0.63	61.21	55.19
2	600	38.8	16.56	17.11	0.55	1.18	32.91	62.87
2	550	38.8	10.92	12.06	1.14	1.87	20.73	32.14
2	500	38.8	10.42	11.60	1.18	0.41	95.05	98.42
2	450	53.5	10.11	10.76	0.65	1.35	39.67	108.75
2	400	53.5	5.83	7.27	1.44	1.07	49.88	67.79
2	350	53.5	3.99	5.68	1.69	0.94	57.06	69.82
2	300	53.5	3.43	4.68	1.25	0.74	72.03	88.76
2	250	53.5	2.44	3.83	1.39	0.68	78.88	118.58
2	200	53.5	1.95	3.35	1.40	0.49	108.19	109.18
2	150	53.5	1.59	3.00	1.41	0.54	98.30	129.90
2	100	53.5	1.13	2.66	1.53	0.42	128.72	151.87
2	50	53.5	0.51	2.61	2.10	0.22	248.07	149.84
2B	850	7.2	108.92	109.75	1.91	1.92	3.76	9.96
2B	800	7.2	95.61	96.65	1.04	1.26	5.72	12.74
2B	750	7.2	87.04	88.10	1.06	2.28	3.16	5.97
2B	700	7.2	80.31	81.24	0.93	1.10	6.54	14.49
2B	650	14.3	71.16	72.44	1.28	2.08	6.89	15.94
2B	600	14.3	57.39	58.51	1.12	2.21	6.82	14.88
2B	550	14.3	44.49	45.69	1.20	2.24	6.38	12.32

Reach	Chainage	Flow	Min Channel Elev.	Water Surface Elev.	Max Channel Depth	Channel Velocity	Flow Area	Top Width
		(m3/s)	(m)	(m)	(m)	(m/s)	(m2)	(m)
2B	500	14.3	30.70	31.91	1.21	2.54	5.62	8.50
2B	450	14.3	15.61	16.57	0.96	1.66	8.60	13.70
2B	400	14.3	13.03	13.68	0.65	0.72	19.92	46.17
2B	350	14.3	8.99	9.41	0.42	1.33	10.72	59.07
2B	300	14.3	5.00	6.17	1.17	0.63	22.77	38.18
2B	250	14.3	3.18	3.72	0.54	1.50	9.51	41.66
2B	200	14.3	1.59	2.64	1.05	0.29	49.77	112.92
2B	150	14.3	1.39	2.61	1.22	0.11	132.22	128.96
2B	100	14.3	0.40	2.60	2.21	0.06	234.68	154.81
2B	50	14.3	0.00	2.60	2.60	0.03	408.76	191.68
3	600	18.5	32.92	33.59	1.97	1.97	9.41	23.76
3	550	18.5	17.60	19.20	1.60	1.48	12.47	13.65
3	500	18.5	13.03	14.10	1.07	2.06	8.98	16.14
3	450	18.5	9.71	10.70	0.99	1.07	17.29	21.38
3	400	18.5	7.38	8.26	0.88	1.20	15.44	28.16
3	350	18.5	6.15	6.61	0.46	0.55	33.80	74.75
3	300	18.5	4.00	5.10	1.10	1.16	15.93	22.17
3	250	18.5	1.87	2.67	0.80	0.72	25.84	80.36
3	200	18.5	1.24	2.61	1.37	0.13	137.79	152.47
3	150	18.5	0.62	2.60	1.98	0.06	326.63	223.37
3	100	18.5	0.25	2.60	2.35	0.04	486.81	267.13
3	50	18.5	0.11	2.60	2.49	0.03	614.35	289.06

Table 3-38: Low Manning's "n" HEC-RAS model results

Reach	Chainage	Flow	Min Channel Elev.	Water Surface Elev.	Max Channel Depth	Channel Velocity	Flow Area	Top Width
		(m3/s)	(m)	(m)	(m)	(m/s)	(m2)	(m)
2	1500	13.1	93.84	94.83	0.99	2.19	5.99	12.26
2	1450	13.1	89.49	90.55	1.06	2.23	5.87	11.56
2	1400	13.1	82.72	84.04	1.32	2.56	5.13	7.75
2	1350	13.1	76.96	78.21	1.25	2.48	5.29	8.46
2	1300	13.1	74.64	74.82	0.18	1.32	9.89	56.47
2	1250	13.1	67.89	68.90	1.01	2.44	5.36	8.82
2	1200	26.2	67.02	67.40	0.38	1.73	15.11	49.61
2	1150	26.2	60.58	61.60	1.02	2.43	10.77	17.91
2	1100	26.2	48.11	49.82	1.71	2.88	9.09	10.71
2	1050	26.2	41.88	43.44	1.56	2.87	9.14	10.98
2	1000	26.2	39.81	40.25	0.44	1.82	14.40	43.14
2	950	26.2	35.47	36.45	0.98	2.34	11.18	19.98
2	900	26.2	33.87	34.71	0.84	2.08	12.61	28.53
2	850	38.8	24.62	25.84	1.22	2.95	13.15	14.87
2	800	38.8	20.40	21.82	1.42	2.76	14.06	18.14
2	750	38.8	19.26	19.92	0.66	1.89	20.50	56.57
2	700	38.8	16.56	17.50	0.94	1.35	28.78	41.50
2	650	38.8	16.56	17.31	0.75	1.55	25.06	40.72
2	600	38.8	16.56	16.92	0.36	1.85	21.03	60.94
2	550	38.8	10.92	11.92	1.00	2.37	16.35	28.59
2	500	38.8	10.42	11.03	0.61	0.92	42.33	84.98
2	450	53.5	10.11	10.68	0.57	1.69	31.58	108.33
2	400	53.5	5.83	6.88	1.05	2.09	25.63	58.08
2	350	53.5	3.99	5.19	1.20	2.09	25.64	58.16
2	300	53.5	3.43	4.15	0.72	1.90	28.10	75.65
2	250	53.5	2.44	3.32	0.88	1.92	27.87	73.54
2	200	53.5	1.95	2.74	0.79	1.18	45.39	92.95
2	150	53.5	1.59	2.59	1.00	1.10	48.48	112.84
2	100	53.5	1.13	2.60	1.47	0.45	118.63	151.71
2	50	53.5	0.51	2.60	2.09	0.22	247.02	149.79
2B	850	7.2	108.92	109.75	1.91	1.92	3.76	9.96
2B	800	7.2	95.61	96.49	0.88	1.89	3.82	10.43
2B	750	7.2	87.04	88.10	1.06	2.28	3.16	5.97
2B	700	7.2	80.31	81.02	0.71	1.88	3.83	10.75
2B	650	14.3	71.16	72.44	1.28	2.09	6.86	15.91
2B	600	14.3	57.39	58.50	1.11	2.33	6.63	14.70
2B	550	14.3	44.49	45.68	1.19	2.26	6.34	12.27

Reach	Chainage	Flow	Min Channel Elev.	Water Surface Elev.	Max Channel Depth	Channel Velocity	Flow Area	Top Width
		(m3/s)	(m)	(m)	(m)	(m/s)	(m2)	(m)
2B	500	14.3	30.70	31.91	1.21	2.54	5.62	8.50
2B	450	14.3	15.61	16.39	0.78	2.27	6.29	11.98
2B	400	14.3	13.03	13.43	0.40	1.55	9.21	37.76
2B	350	14.3	8.99	9.41	0.42	1.33	10.72	59.07
2B	300	14.3	5.00	5.68	0.68	1.84	7.79	22.84
2B	250	14.3	3.18	3.72	0.54	1.50	9.55	41.69
2B	200	14.3	1.59	2.60	1.01	0.32	44.92	112.56
2B	150	14.3	1.39	2.60	1.21	0.11	131.04	128.83
2B	100	14.3	0.40	2.60	2.20	0.06	233.97	154.77
2B	50	14.3	0.00	2.60	2.60	0.04	408.05	191.65
3	600	18.5	32.92	33.59	1.97	1.98	9.36	23.71
3	550	18.5	17.60	18.78	1.18	2.55	7.24	10.91
3	500	18.5	13.03	14.05	1.02	2.26	8.18	15.68
3	450	18.5	9.71	10.25	0.54	2.16	8.56	17.88
3	400	18.5	7.38	8.04	0.66	1.92	9.63	25.83
3	350	18.5	6.15	6.34	0.19	1.34	13.76	73.37
3	300	18.5	4.00	4.74	0.74	2.16	8.55	18.06
3	250	18.5	1.87	2.57	0.70	0.98	18.81	64.22
3	200	18.5	1.24	2.60	1.36	0.14	136.81	152.25
3	150	18.5	0.62	2.60	1.98	0.06	326.29	223.35
3	100	18.5	0.25	2.60	2.35	0.04	486.69	267.12
3	50	18.5	0.11	2.60	2.49	0.03	614.35	289.06

The following observations were made from the hydraulic modelling of the channels under developed conditions:

- 1 in 100 year ARI event flows are contained within the main channel sections, and are within the areas unsuitable for development as determined in the "Area E" – Terranora – Planning Report & Structure Plan for Terranora Landowners Group, (Jim Glazebrook & Associates Pty Ltd, 2002. With the exception of upstream of chainage 500 in Reach 2B;
- channel top widths are on average 60 m (low Manning's "n") and 65m (high Manning's "n");
- the top channel width for Reach 2 chainages 450 – 750, 1200 and 1300, Reach 2B chainage 350 and Reach 3 chainage 350 are affected by existing farm dam in these locations;
- velocities within the channels are on average 1.2 m/s (high Manning's "n") and 1.7 m/s (low Manning's "n"), which is reasonable, considering the steepness of the channels; and
- maximum velocities within the channels range up to 2.95 m/s, at the steepest sections.

3.4.6 Recommendations

The issues discussed in the previous sections provide an understanding of the stormwater issues associated with the development of the Tweed Area "E". The following table discusses a number of recommendations and management actions based on this information.

Table 3-39: Recommendations and management actions

Item	Recommendation	Management Action
1	Adopt relevant source controls to limit development impacts	Educate the community about environmental values and the importance or maintaining water quality from the catchment.
2	Adopt a treatment train approach for structural stormwater controls	Adopt the treatment train measures modelled in mitigation option 4 that include rainwater tanks, grassed swales, bio-retention and wetlands. Identify any site constraints during the preliminary design stage to ensure that measures can perform efficiently.
3	Ensure all treatment measures adopt best practice design guidelines to ensure maximum performance.	Adopt the design parameters discussed with each mitigation option unless further modelling or analysis suggests otherwise. Councils design specifications, D5 – Stormwater Drainage and D-7 Water Quality, together with other best practice design guidelines should be referenced together with the Council's Subdivision Manual Development Control Plan No 16.
4	Undertake a monitoring program to identify the impact of development and the performance of adopted treatment measures	Monitor background water quality pollutants in Terranora Broadwater and the adjacent wetlands. Continue to monitor during development construction and the operational period to determine development impacts and the performance of adopted treatment measures. Review monitoring results to highlight elevated parameters that may harm environmental values. Identify catchment activities resulting in poor water quality and take action to limit the impacts.
5	Rehabilitate existing main flow paths	Protect natural gullies and retain for overland flow paths for all storm events Rehabilitate existing gullies with natural vegetation where required to protect against erosion and provide valuable habitat.
6	Adopt rainwater tanks to reuse stormwater and save potable water supply	Promote the use of roof water tanks to collect and store stormwater. It is suggested that the tanks are buried to allow collection from all roof areas and save space. A pump will be required to circulate water for non-potable uses around the home.

The MUSIC model analysis indicates that the recommended stormwater treatment train measures reduce developed pollutant loads sufficiently to meet Council's water quality objectives (TSS, TN and TP).

Although the modelling suggests that the treatment train mitigation option 4 (WSUD incorporating wetlands) provides little benefit in terms of reducing nutrient loads entering the Terranora Broadwater, it is recommended that they be considered as part of the stormwater treatment strategy for the area. The wetlands will provide additional treatment should the actual performance of the grassed swales or bio-retention be less than expected due to alternative lot layouts or site constraints not previously identified. The wetlands will provide additional benefits such as the attenuation of more frequent events and assist in limiting the impact of increased levels of imperviousness through the new development. The measures also assist in minimising the disturbance of development on flow regime with a wide range of flows mimicking natural flow frequencies.

The cost estimates for the mitigation options, indicates that the rainwater tanks and wetlands are high compared with the costs of grassed swales and bioretention systems, however the cost of rainwater tanks could be met by developers or residents. Subsidies could be provided to residents, as occurs in other local authorities, to encourage their use. Alternatively, Council could request that they be mandatory for all residents as a development constraint to ensure compliance with the WSUD approach to stormwater within the development area.

3.5 Biting Insects

Development Control Plan No 25 - Biting Midge and Mosquito Control identifies parts of Area E adjacent to Terranora Broadwater as mosquito breeding habitat (see Figure 3.31). As a general rule, the areas where biting midge and mosquito problems will regularly be a nuisance to humans will be within 1km of extensive biting insect breeding areas. It is noted from the DCP that habitat changes caused by some forms of development, such as creation of canal estates, reduced water quality through nutrient load or acidic runoff, altered drainage systems and siltation problems may expand biting insect problems.

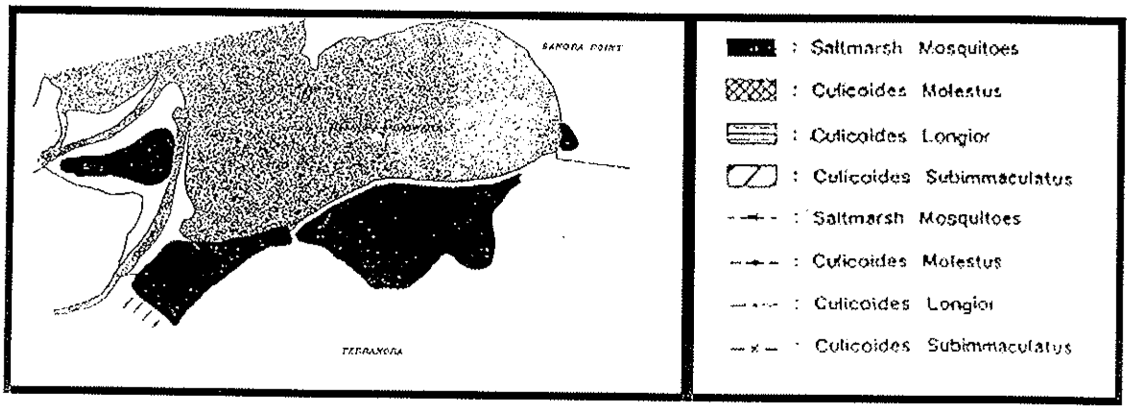

Figure 3-31: Saltmarsh mosquito habitat (Source: DCP 25, Tweed Shire Council, 1993)

Mosquitoes in general are opportunistic feeders that will feed on many species of birds and mammals. Humans tend to be the most abundant source of food in many local areas close to wetland breeding areas favoured by these insects. Problems therefore arise where human activities or habitation, occur in proximity to these insect breeding areas. The extensive areas of wet low-land and intertidal areas along the Tweed coastal districts represent extensive breeding areas for both mosquitoes and biting midge. As a result of the proximity of these low-land areas and urban development in the Tweed Council area, biting insect nuisance is likely to occur in many areas within this district from time to time.

Mosquitoes are an important group of blood sucking insects, not only because of the nuisance and annoyance of their bite but also because of the possibility of disease transmission to humans and other warm blooded animals. It is as vectors of disease that mosquitoes are often of most concern. An insect that transmits a disease-causing organism from one vertebrate host to another is called a disease vector. An example of a disease transmitted locally by mosquitoes is Ross River Fever (TSC, 1993).

Discussions with Tweed Shire Council's entomologist further identified that the area of wetlands was previously modified with the resulting effect being a change form a largely freshwater to a saline hydraulic regime which has created breeding habitat for salt marsh mosquitos. Salt marsh mosquitoes have an extensive range and in the right climatic conditions could range throughout the extent of the study area which would affect the potential for residential development of this land.

Without rehabilitation to return the wetlands to a largely freshwater regime the salt marsh mosquitoes from the wetlands area would be an ongoing cause of nuisance to any residential development within the vicinity. There is also the potential of further saline influence which would be triggered by the failure of existing floodgates could result in the area also becoming potential breeding habitat for biting midge, that would further compound insect nuisance not only within Area E but also within surrounding residential areas (Clive Easton, pers. comm. 2003).

Biting insect problems associated with this area would be exacerbated by the introduction of increased population numbers that would result from residential development of the area and would require frequent intervention by Council to address the problem, as such becoming a long term issue to Council.

The potential solution to this issue is to undertake rehabilitation of the wetlands area to return it largely to a freshwater regime which would eliminate breeding habitat for salt marsh mosquitoes. This would also have the advantage of ensuring that this area of known PASS/ASS was kept inundated thus limiting potential for ASS discharge events. While the area would still provide breeding habitat for freshwater breeds of mosquitoes their effective range is substantially limited and with control of vegetation corridors which may provide routes for mosquito travel their range could be substantially contained to areas adjacent to the wetlands area.

Appropriate measures for the rehabilitation of the wetlands areas will need to be determined via further studies of the site and the funding for rehabilitation could be dealt with through the introduction of a Section 94 Plan that levied contributions towards these works. Alternate sources of funding may include wetland funding opportunities available from State and federal government Sources.

3.5.1 Summary and conclusion

It is noted above that biting midge and mosquito problems will regularly be a nuisance to humans within a 1 kilometre radius of extensive biting insect breeding areas. The development that has been undertaken within the surrounds of Area E has caused habitat changes and therefore reduced water quality through nutrient load or acidic runoff, altered drainage systems and siltation problems that may expand biting insect problems.

The wetland area has been modified from its historical form resulting in the change from largely freshwater to a saline hydraulic regime. This change in hydraulic regime has created a breeding habitat for salt water marsh mosquitos. Furthermore, if a failure of the floodgates occurs, this could lead to further saline influence resulting in a favourable breeding habitat for the biting midge. This would provide a nuisance not only within Area E but also within surrounding residential areas.

3.5.2 Recommendations

The key recommendation for biting insects is for the rehabilitation of the wetlands area to return it largely to a freshwater regime ensuring the elimination of potential breeding habitat for salt marsh mosquitoes. The freshwater mosquito species have a substantially limited range of nuisance. Furthermore, this action would also ensure that the areas identified as PASS and ASS remains inundated, limiting potential ASS discharge events.

In addition, the preservation of vegetation corridors will provide routes for mosquito travel and thus contain mosquitos to areas adjacent the wetlands area.

Rehabilitation of this wetland and the subsequent positive impacts on saltmarsh mosquito breeding habitat will benefit the whole of Area E and as such it is appropriate that all landholders contribute to the rehabiltiation of the wetland. In the first instance a study to determine the appropriate rehabilitation measures should be undertaken and a subsequent Section 94 contribution plan developed to ensure that funds are collected for the wetland rehabiltiation.

3.6 Contaminated Land

In order for Area E to be redeveloped, the land should be suitable for its intended use. This requires that the presence and concentration of contaminants (if any) is investigated with the appropriate rigour. Concentrations of contaminants (if present) must be within the appropriate guideline levels for the land uses proposed. This review assesses the prior work done at the site, some of the uncertainties with respect to the contaminant potential at the site that have not yet been addressed and a method for assessing and remediating potential contaminant impacts while a staged development process in line with the SEPP 55 requirements.

3.6.1 Potential Contaminants of Concern

Based upon a review of prior reports and prior experience on contaminants on rural properties, the potential contaminants of concern include contaminants from the following sources:

- Septic tank and sewerage systems;
- Farm pesticide and chemical storage;
- Farm cattle dips;
- Farm fuel storage;
- Farm waste disposal;
- Asbestos and lead paint containing building materials; and
- Diffuse source pesticide application.

The indications or potential for these contaminant sources and the proposed analyses to assess potential impacts are discussed below.

3.6.2 Septic Tank and Sewerage Systems

Septic tank systems can be a source of localised soil and groundwater contamination for Faecal Coliforms, E.Coli and a range of other bacteriological contaminants.

The Draft Interim Strategic Plan (TSC, 1995) states "there are widespread concerns of the efficiency of current effluent disposal system in use in rural areas (eg, septic tanks, envirocycle systems)'.

This highlights the potential for bacteriological contamination of soils at poorly run or maintained septic systems.

3.6.3 Pesticides and Farm Chemicals

The Ardill & Associates report (1993, table 3) identified the presence of 'arsenic and endosulfan residues below EPA concerns' on land adjacent to the study area. The study undertaken in 1992 analysed targeted samples for arsenic, organochlorine and organophosphate pesticides. Five samples were collected and results showed low levels of arsenic in excess of background concentrations, endosulfans, and DDE at detectable concentrations. While concentrations recorded were within guidelines (at the time) for low density residential land use, the sample density is not sufficient to meet current guidelines and serves to indicate the presence of contaminants in the area.

Wilkie Fleming and Associates (1994) reported results for samples collected for a preliminary assessment of the site. Sampling was undertaken at a rate of one sample per 20 ha. More detailed sampling is recommended by NSW EPA guidelines to assess banana plantation sites.

Samples were composited from five sub-samples. The NSW EPA guidelines for assessing Banana Plantation Sites (1997) and NEHF (1996) Composite Sampling monograph recommend that no more than four samples are composited. In addition, the compositing of samples by mixing can lead to loss of semi-volatile and volatile components.

The samples for the Wilkie Fleming and Associates (1995) study were reportedly mixed by 'thorough mixing of the cores in a clean plastic bucket'. Therefore, semi-volatile pesticides could have been lost in the process.

In addition, when comparing the analytical results of a composite sample analysis to an investigation guideline, the guideline should be divided by the number of samples forming the composite (NEHF, 1996). If the results are compared to guideline values as adjusted for a composite, sample nine samples exceed the adjusted guideline for DDT.

Table 3-40: Analytical results from Wilkie Fleming and Associates (1995) & adjusted guideline values

	DDE	DDD	DDT	OPs	As	Pb
Field No						
T01/1	<0.02	<0.02	<0.02	<0.1	8	<10
T01/2	<0.02	<0.02	<0.02	<0.1	6	<10
T02/1	0.15	<0.02	0.04	<0.1	10	<10
T02/2	0.17	<0.02	0.04	<0.1	14	<10
T02/3	0.15	<0.02	0.06	<0.1	3	<10
T03	<0.02	<0.02	<0.02	<0.1	18	<10
T05	0.03	<0.02	<0.02	<0.1	10	<10
T07/1	0.08	<0.02	<0.02	<0.1	5	<10
T07/2	<0.02	<0.02	<0.02	<0.1	8	<10
T08	0.2	<0.02	0.08	<0.1	2	<10
T09/1	<0.02	<0.02	<0.02	<0.1	17	<10
T09/2	<0.02	<0.02	<0.02	<0.1	11	<10
T10/1	0.23	<0.02	0.12	<0.1	7	<10

		DDE		DDD	DDT	OPs	As	Pb
T10/2		0.27		<0.02	0.19	<0.1	6	<10
T11		0.31		<0.02	0.21	<0.1	8	<10
T12/1		0.25		<0.02	0.24	<0.1	4	<10
T12/2		0.13		<0.02	0.07	<0.1	9	<10
Guideline	0.01[1]	4[2]	1.7[3]		0.2		100	300
Composite Adjusted Guideline	0.002	0.8	0.34		0.04		20	60

1 - MHSPE 2000 Dutch target value

2 - MHSPE 2000 Dutch trigger value

3 - US EPA Preliminary Remedial Goal for residential land use.

Other chemicals used on farms are often stored in farm sheds and handling practices often lead to localised spills. Common farm contaminants include:

- Organochlorine and organophosphate pesticides;
- DDT and derivatives;
- Herbicides;
- Arsenic based dips and sprays; and
- Petrol and diesel fuels.

A site visit of the area identified an above ground diesel storage tank (c. 1,000 L), electrical transformers (potential source of PCBs) and pesticide and herbicide storage in earthen floored sheds, and dumping of empty and partially full containers including:

- Lorsban (organophosphate pesticides);
- Dimethoate and Gramoxone (paraquat);
- Roundup (glyphosate, POEA);
- Nematicides (organspohosphates/carbamides);
- Oils; and
- Split bags of a white powder (either superphosphate, pesticides or arsenic).

As well as indicating point source areas of potential contamination where chemical handling took place, the chemical storage area also indicates the potential for broad acre use of pesticides at the site.

3.6.4 Recent Report Review

An assessment of the potential for contaminant impacts was undertaken on certain lots by Gilbert & Sutherland in 2003.

Review of the report has highlighted the following uncertainties with respect to the requirements for assessing site contamination.

The site history provided in the report does not meet NSW EPA requirements for reporting and should be revised to include all the information required by the NSW EPA.

The sampling strategy is based upon an assessment of human health impacts from soils at the site, sampling also needs to assess the potential for environmental impacts to dams and sediments as these areas could from sinks for contaminants build up and areas where bioaccumulation of contaminants could later impact human health (i.e. yabbies in dam bioaccumulate contaminants and are later caught by children/residents and eaten).

Farm chemical storage areas appear to have either have targeted samplings occurred around rather than in the storage areas, or have not had targeted samples collected.

A stock race at Lot 2/77827 was not reported on or targeted for the presence of dip chemicals.

Samples with elevated detection limits (i.e. sample #A Shed in Lot1 DP215959 reported a MDL of <3.56 for DDT+DDD+DDE) do not have an explanation for the raised detection limit.

The interpretation of the human health analytical results does not include an assessment of compounds detected such as Endosulfans. Endosulfans were detected in samples #A Shed at 20.53 mg/kg for a total of Endosulfan1, Endosulfan2 and Endosulfan Sulfate. While there are no Australian guideline criteria for Endosulfans, the Dutch (MHSPE 2000) guideline intervention value is 4 mg/kg and is exceeded by both individual and total Endosulfan results. The Dutch intervention values are indicative of the level of impact above which there is a serious case of soil contamination. This result does not correlate with the conclusion of the report that "As no contamination hotspots were encountered, no additional sampling or analysis appears to be required". Further assessment of this result is required and this highlights the need for a NSW EPA accredited auditor to be involved in the review of assessment reports, the development control plan for the site and final statutory sign-off for residential landuse.

3.6.5 Waste Disposal

In addition to localised contamination around storage areas, pesticides and other contaminants can impact soils from diffuse source use and inappropriate disposal in farm rubbish dumps. Drums were seen dumped up to 50m from the chemical storage area.

3.6.6 Groundwater

Shallow groundwater is present within the upper 5m of the soil profile and often within 1 m of the surface (Wilkie Fleming and Associates 1995). Therefore, if significant soil impacts are present there is potential for soil impacts to impact groundwater at the site.

3.6.7 Contaminated Land Assessment

A review of prior data and common practices for the past land uses at the site indicate that both identified contamination and the potential for further contaminants to exist at the site. Interim advice has been received from an Accredited Site Auditor (Marc Salmon of JBS Environmental (NSW EPA 0103)) indicating that no information has been revealed during the review of documents or site inspection which would preclude the rezoning of the site to a residential with accessible soil landuse (Column 1, EPA 1998), provided measures are put in place to ensure that the potential for contamination and the suitability of the land for any proposed use are assessed once detailed proposals are made.

Figure 3.32 illustrates potential contaminants sources, and receptors identified to date.