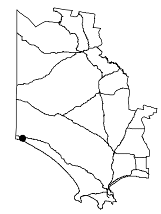
NELSON
TOWN REPORT
March 2009



INTRODUCTORY COMMENTS

Nelson is a very small town located on the Glenelg River near the South Australia border approximately 60km west of Portland. Electricity is connected but there is no reticulated water, sewerage or gas. A general store offers some basic services and there are no community facilities. There is a hotel, caravan / cabin park, and a public toilet block. Nelson is too small to be documented as a town by the ABS, so no census statistics are available. Analysis of the air photo reveals that there are around 200 dwellings and a similar number of undeveloped parcels (Map 1). There are probably around 200 permanent residents, and it is likely that the caravan park is a popular tourist destination, particularly over summer.

Nelson is sandy rise country. To the east of the Glenelg river and north of Mark Street the topography is quite gentle (Tmg geology with marly limestone). The remaining developed parts of Nelson are in steeper country where slopes can exceed 20% (Qpb geology with old calcareous sand dunes and secondary dune limestone). In spite of the topographical variation that delineates the two geologies, the soils within Nelson are uniformly AS/NZS category 1.

Nelson consists of over 300 Township Zone parcels (over 250 properties) (Map 2). Most of these have areas less than 800m^2. Most of the domestic wastewater systems in the town are likely to consist of a septic tank with trench wastewater disposal. A serious wastewater impact relates to groundwater. Category 1 soils are so permeable and soil percolation rates so rapid that while they are undoubtedly effectively disposing of septic effluent, unless trench systems are supported by a dosing pump and uniform effluent distribution little effluent treatment would be occurring in the soil. Therefore the bulk of microbial and chemical contaminants may well reach the groundwater table and pollute the groundwater. This is concerning given that there are likely many bores in the town, and that septic systems are in close proximity to the Glenelg river. Clearly, there is great potential for off-site impacts in Nelson and Council needs to pay close attention to the onsite technologies being used there.

It is our belief that no further trench systems should be permitted in Nelson and that efforts should be made to upgrade traditional trench systems.

WASTEWATER MAPPING

Maps 3 thru 10 apply the AS/NZS and Code Of Practice in various ways to the Nelson town area.

Development density series

Map 3 thru map 5 represent the current capacity for local areas to deal with wastewater onsite, and the likelihood that if fully developed they could deal with wastewaters onsite using trench and irrigation systems.

- Using trench systems a three bedroom home would require at least 1122 m^2 to adequately deal with its wastewater on AS/NZS category 1 soils (ie. 450m^2 of impervious surfaces plus 336m^2 disposal area plus 336m^2 reserve area - see table 6 in the report introduction). No new trench systems should be allowed in Nelson. We have modelled this theme only for the purpose of understanding the sustainability of existing onsite systems.

- Using irrigation systems a three bedroom home would require at least 635 m^2 to adequately deal with its wastewater on AS/NZS category 1 soils (ie. 450m^2 of impervious surfaces plus 185m^2 disposal area - see table 3.1).

Map 3 assumes that trench systems are used throughout Nelson and so represents the likely present sustainability of areas. It assumes that dosing pumps are in use. Eleven areas in the town are shaded either red or amber meaning that on average the present density of development there is greater than would support a 3 bedroom home. The area south of Kellett Street is a caravan park.

Map 4 represents the sustainability of areas if all parcels were to be developed using trench systems. Additional areas are shaded either red or amber, especially in the Moonah Avenue area. In this scenario, much of Nelson would be producing wastewater in excess of what could be treated onsite if it were to be fully developed with three bedroom homes.

Map 5 represents the sustainability of onsite systems in Nelson if all parcels were to be developed and all developments were to make use of irrigation technology. The area bound by Mitchell Street, Casuarina Grove and North Nelson Road remains a problem.

Constraints

Map 6 shows slope and stream buffer constraints in relation to properties and parcels. The Code of Practice (EPA 2008) prohibits the consideration of land for wastewater absorption fields if within 6 metres upslope or 3 metres downslope of an adjacent allotment. Buffer distances from adjoining allotments are reduced by up to 50% if irrigation systems are used. In map 6, allotments are buffered by 3m for input into the trench system models (red) and 1.5m for input into the irrigation system models (pink) on the basis of our recommendation that all wastewater systems should be pressurised. Also, the Land Capability Assessment for Onsite Domestic Wastewater document (EPA 2003) suggests that slopes exceeding 20% are constrained. We show slopes as three classes (0-17% is unconstrained, 18-22% requires inspection and >22% is constrained).

Trench performance series

The trench system series (Map 7 and Map 8) gives some indication how existing systems might be performing in terms of surface runoff potential and does not account for impacts on groundwater, which will be greater where dosing pumps are not in use.

Map 7 shows that there are a significant number of properties with limited development potential. Many of these are already developed, so there are probably already wastewater problems in the town. Due to the high permeability of sandy soils, these problems may be invisible.

Map 8 shows that most parcels in Nelson have limited development potential if trench technology is used. Severe problems might emerge if Nelson was to be fully developed using traditional trench technologies.

Irrigation performance series

The irrigation map series (map 9 and map 10) shows that many blocks constrained when trench systems are used, are not constrained when irrigation technologies are used. In the long term however, some problems would remain, especially in the area bound by Mitchell Street, Casuarina Grove and North Nelson Road.

Map 9 represents the present ability of the local soils to deal with wastewater onsite if all existing development was to be upgraded to irrigation technology. There is a cluster of properties in the north of the town that would still be unable to deal with wastewaters onsite. Most of these properties are already developed.

Map 10 represents the overall effect of using irrigation technology should all parcels be developed in the future. There are smatterings of red and amber throughout the town, but the area bound by Mitchell Street, Casuarina Grove and North Nelson Road would emerge as a serious problem.

RECOMMENDATIONS AND CONCLUSIONS FOR IMPROVING SUSTAINABILITY

Failing or inappropriate onsite wastewater systems create concerns for human health and the health of the environment. We have some major concerns for Nelson. Each of the maps 3 thru 5 and 7 thru 10 flag the area bound by Mitchell Street, Casuarina Grove and North Nelson Road as being a problem. This area has small blocks, is in close proximity to the Glenelg River, and is near-fully developed. All the maps relating to trench systems have been produced based on the assumption that the systems are properly maintained and are accompanied by dosing pumps. The reality is that these technologies and maintenance regimes are unlikely to be in place for all developments. Category 1 soils are so permeable that the most likely wastewater impact relates to groundwater, and only in extreme circumstances would offsite effects such as overland flow of effluent into adjoining public and private spaces be important.

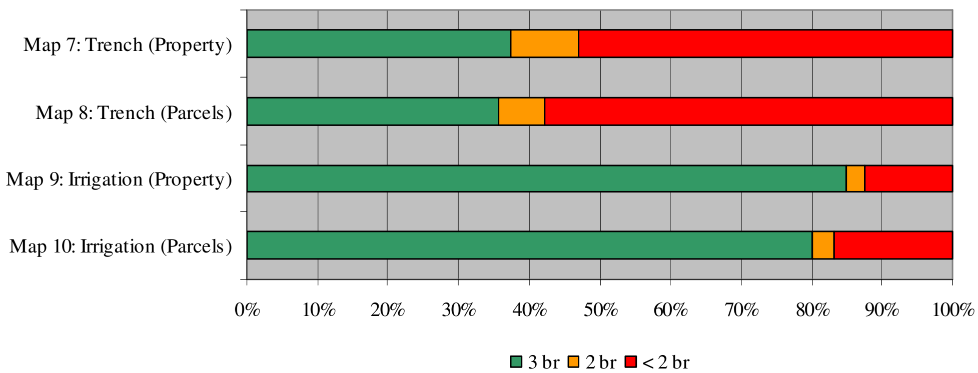


Chart 1: This chart illustrates the information shown in Maps 7 thru 10. It gives an impression of the impact that changes in technology and planning approaches make on the sustainability outcomes for development in the towns. The change from trench technology to irrigation technology makes an enormous difference to the sustainability outcomes for this town. The red area represents a number of blocks clustered in the northern part of the town that in each of the four scenarios are consistently modelled as being unsustainable for onsite systems. Council should investigate CED sewerage options for this cluster.

In the absence of reticulated sewerage, the maps and Chart 1 suggest that for many blocks the situation would improve if irrigation systems were to be adopted. In fact, due to the high quality wastewater produced by Aerated Wastewater Treatment Systems, in the absence of reticulated sewerage the sustainability of all sites would be improved if upgraded to irrigation systems. For some sites where trench systems are being replaced, it may be necessary to re-use existing trenches for AWTS treated water, or to install irrigation lines within existing trench areas.

Recommendation: The maps indicate that the trench systems that are likely to be installed throughout the town are unsustainable on most blocks, and also that wastewater issues should be approached differently in different areas of the town. We suggest two approaches to dealing with this. Our most preferred is Approach 1 and our least preferred is Approach 2.

- **Approach 1:**
  - The area bound by Mitchell Street, Casuarina Grove and North Nelson Road should be sewered. A Common Effluent Drainage system would be the most practical.
  - In the remainder of the town, on blocks shaded red, trench systems should be upgraded to be irrigation systems.
- **Approach 2:**
  - Upgrade trench systems in the area bound by Mitchell Street, Casuarina Grove and North Nelson Road to irrigation systems.
  - Adopt a policy that would lead to the long term upgrading of trench systems in the remainder of the town to irrigation systems. Permit approval might be the trigger for this. Priorities should be blocks:
    - Using onsite systems that would not currently be approved (eg. soakage pits, blackwater only systems).
    - Mapped as being unable to sustain a three bedroom house.
  - Manage remaining problems.

Problems to manage

- Audit of existing systems in areas shaded red in map 7.
  - Document onsite technology being used.
  - Initial desludging of all tanks.
  - Establish system to monitor future desludging.
- Begin a community awareness campaign to encourage:
  - The use of water saving devices and practices. The motivation for this is wastewater reduction rather than reduced water consumption.
  - The maintenance and care of septic tanks.
  - Effective operation of trenches through the installation of dosing pumps.
- Full Land Capability Assessment to be undertaken for development proposals that deviate from the wastewater technologies discussed in this document, or are shown to be unsustainable in Map 9 or Map 10.
- Ensure the regular maintenance of AWTS in accordance with certificate of approval.
- Where bores exist, the water could become contaminated from wastewater and health problems result.
  - Observe setback distances between disposal fields and bores that are set out in the Code Of Practice.
  - Discourage use of bore water for potable supply.
  - Promote secondary treatment and disinfection

Notes on upgrading existing septic tank systems

- Irrigation technology is the preferred option and implies the installation of AWTS. Wastewater should be treated to a 20/30 standard.
- A professionally designed and constructed sand filter would be an acceptable alternative technology.

- A dosing pump provides intermittent loading and uniform distribution of effluent. It is a relatively inexpensive option that would give immediate benefit to most blocks. It will not make a trench system more sustainable, but rather will ensure that it is performing the best it possibly can. A dosing pump might be connected to existing trenches or extended trenches.
- Aerated Wastewater Treatment System (AWTS) in combination with extended trenches and a dosing pump would be another option

REFERENCES

Australian / New Zealand Standard, On-site domestic-wastewater management – AS/NZS 1547:2000, 2000

DPI Victoria, 2007, Geoscientific data DVD (geological boundaries were reinterpreted using 1 metre contours provided by the shire)

EPA, Guidelines for Environmental Management – Septic Tanks Code of Practice, Publication 891.2, December 2008

EPA, Land Capability Assessment for Onsite Domestic Wastewater, Publication 746.1, March 2003

ACKNOWLEDGEMENT

Extensive use has been made of an earlier wastewater report produced by Mr Larry White.

NELSON PREFERRED MANAGEMENT OPTIONS

Table 2: Climatic Regime (mm) – Meteorological Stations: Nelson for rainfall, Mount Gambier for rainfall and evaporation.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean Rainfall	26.9	26.1	34.9	54.8	72.1	83.8	98.8	93	72.6	62.2	46	37.2	706.9
Mean Pan Evap'n	209	184.3	147.1	88.1	53	36.4	41.9	58.8	79.8	113.9	142.2	183.1	1337.6
Crop Factor	0.70	0.70	0.70	0.60	0.50	0.45	0.40	0.45	0.55	0.65	0.70	0.70	
Mean Pot'l Evapotrans'n	146.3	129.0	103.0	52.9	26.5	16.4	16.8	26.5	43.9	74.0	99.5	128.2	862.9
Water Deficit	119.4	102.9	68.1							11.8	53.5	91.0	446.7
Water Excess				1.9	45.6	67.4	82.0	66.5	28.7				292.3
90-Percentile Rainfall	53.8	55.7	62.6	96.9	128.4	144	143.6	145	100.6	106.1	73.6	63.2	855.9

The 90-Percentile annual rainfall[1] is the total yearly higher than normal rainfall that on average occurs only once in ten years, and it is made up by some parts of the year having sufficiently higher than average rainfall. It is based on a long historical period of rainfall measurements. This index is used in EPA publications on irrigation of large scale industrial and municipal wastewater and also for grey water re-use schemes. In Nelson the 90-percentile high rainfall is about 21% higher than the mean annual rainfall.

During an average rainfall and evaporation year, there will be six months that have more rainfall than will be transpired by a grassed surface. The excess rainfall in these months is about 290 mm. The excess rainfall water will infiltrate into the soil and some of it will be stored in the soil profile, becoming available for use during the six drier summer months when the total deficit amounts to approximately 450 mm. However, sandy soils have a low water holding capacity and therefore some of the excess will be lost to deep drainage.

Most of the township is situated on rolling old sand dunes with much secondary lime stone (dune limestone) scattered throughout the soil profile, mapped geologically as Qpb (Bridgewater Formation: dune limestone, shell beds and calcareous sand) but towards Huebners Road in the north the topography is much more gently undulating and mapped as Tmg (Tertiary lime stones, marls, with thin siliceous sand cover). All these areas have sandy soils with varying amounts of, but often much limestone which may be hard or soft. The sand between the dune lime stone is highly permeable. It is likely that the groundwater is of good potable quality but hard with dissolved calcium.

The major part of the township has been mapped as Nelson land system in the Glenelg Soil Health Strategy, with the more gently undulating land to the north mapped as Heywood land system. To the south the swampy areas and lakes are mapped geologically as Qrs (Swamp, lake margin, lagoon, heath, marsh, minor sand sheet) and as Long Swamp land system. There is no residential development in this area.

[1] The 90-Percentile annual rainfall is very much less than the sum of the 90-Percentile monthly rainfalls because the chance of having twelve months in succession each with the 90-Percentile high rainfall is vanishingly small. The chance of any one month having a 1 in 10 month high rainfall is 1:10 or 0.1 per definition. This is true for each month in the year. The chance that in one year two months will each have a 1 in 10 high rainfall therefore is 1:100, or 0.01 or 1 in 10^2. Thus for all twelve months in the year to have a 1 in 10 high rainfall is 1 in 10^{12} or 1 in a trillion years.

Table 3.1 Management for vacant allotments

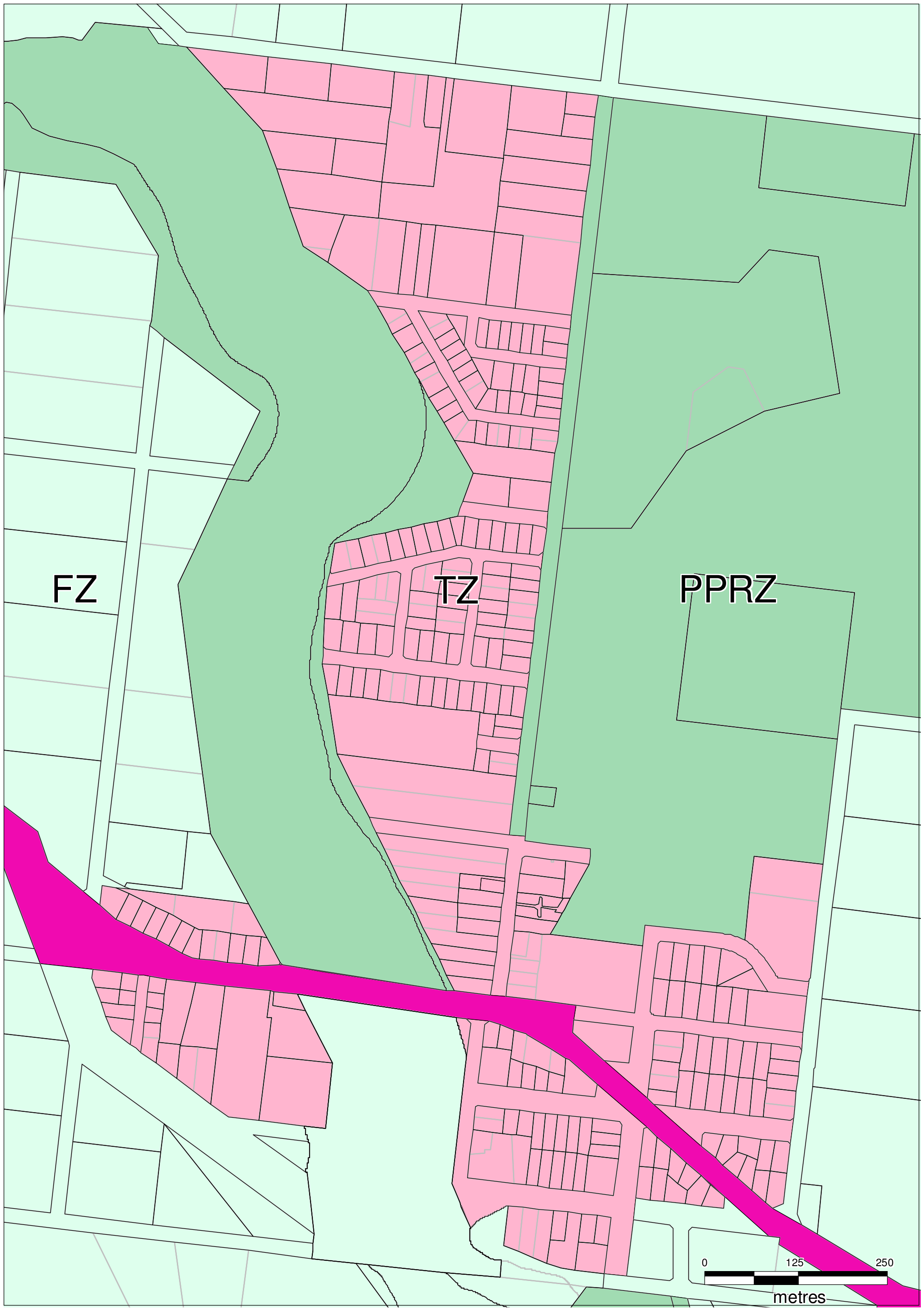
Soil Category	Soil, Geology & Topography	Indicative permeability (Ksat)	Waste water management system	Design Loading rate	Area required for waste water management system
1	Dune Sand & Dune Limestone Soils, soils on marl (Qpb, Tmg) Deep calcareous sands with common secondary dune limestone throughout Moderately steep and irregular topography in most of the area, but gently undulating in the north	> 3.0 m/day	Absorption trenches & beds Standard 0.5 m wide; unit length 10 m; spacing 2 m + 2 m envelope	Not appropriate due to excessive permeability	n/a
			Evapo-Transpiration Absorption – Seepage Trenches & Beds EPA CA 01.2/3 for annual rainfall 700 mm AS/NZS 1547:2000 Annual rainfall is not a factor for sizing in AS/NZS.	Not appropriate due to excessive permeability	n/a
			Mounds AS/NZS 1547:2000	Not appropriate due to excessive permeability	n/a
			Irrigation Systems AS/NZS 1547:2000 Secondary treated effluent only	Irrig'n area DIR = 5 L/m^2.day but preferably less	Disinfection desirable to protect groundwater 1 br: 230 L/day – 120 m^2 2 br: 345 L/day – 153 m^2 3 br: 460 L/day – 185 m^2 4 br: 575 L/day – 217 m^2
			Irrigation Systems MAV Model for Sensitive Sites Secondary treated effluent only		MAV Spreadsheet; Parameters: Crop N Uptake 150 kg/ha; Crop P Uptake 40 kg/ha; P sorption 400 mg/kg soil; Bulk Density 1.5 c/cm^3; Depth of soil allowing for rock 2.0 m

Comments – Soil and other terrain features:
Mapped as Nelson and Heywood Land Systems in the Glenelg Hopkins Catchment Regional Soil Health Action Plan.

Table 3.2 Management for existing premises					
Soil Category	Soil, Geology & Topography	Indicative permeability (Ksat)	Waste water management system	Design Loading rate	Area required for waste water management system
1	Dune Sand & Dune Limestone Soils, soils on marl (Qpb, Tmg) Deep calcareous sands with common secondary dune limestone throughout Moderately steep and irregular topography in most of the area, but gently undulating in the north	> 3.0 m/day	Absorption trenches & beds Standard 0.5 m wide; unit length 10 m; spacing 2 m + 2 m envelope	20 mm/day	Upgrade by installing an AWTS, and extend trenches to maximum possible, install pressurised dose loading and install water saving appliances
			Evapo-Transpiration Absorption – Seepage Trenches & Beds EPA CA 01.2/3 for annual rainfall 700 mm -- AS/NZS 1547:2000 Annual rainfall is not a factor for sizing in AS/NZS.	Loading Rate as per EPA CA 01.2/3. ------------------ Calculate Water Balance as per AS/NZS Appendix 4.2D for each month and full year.	Upgrade by installing an AWTS, and extend trenches to maximum possible, install pressurised dose loading and install water saving appliances
			Mounds AS/NZS 1547:2000	5 L/m^2.day	Upgrade by installing an AWTS, and extend trenches to maximum possible, install pressurised dose loading and install water saving appliances
			Irrigation Systems AS/NZS 1547:2000 Secondary treated effluent only	Irrig'n area DIR = 5 L/m^2.day or less	Extend irrigation area where possible and reduce loading rate; install water saving appliances
			Irrigation Systems MAV Model for Sensitive Sites Secondary treated effluent only		

Comments – Soil and other terrain features:
Mapped as Nelson and Heywood Land Systems in the Glenelg Hopkins Catchment Regional Soil Health Action Plan.

Map 1: Air photo of Nelson overlaid with 5m contours. Although there is less relief to the north, Nelson is uniformly an AS/NZS category 1 soil.



Map 2: Planning zones in the area are the Township Zone (TZ), Farming Zone (FZ) and Public Park And Recreation Zone (PPRZ). Properties have black boundaries and parcels have grey boundaries

Map 3: Present sustainability of trench systems on Nelson's AS/NZS category 1 soils.[2] The map assumes that each dwelling uses an all-waste system and a dosing pump. In the red and amber areas, the average present density of development is such that in order to be sustainable, all homes there would need to be 2 bedrooms or smaller. The red area in Kellett Street is a caravan park.[3] Only areas with dwellings are shaded.

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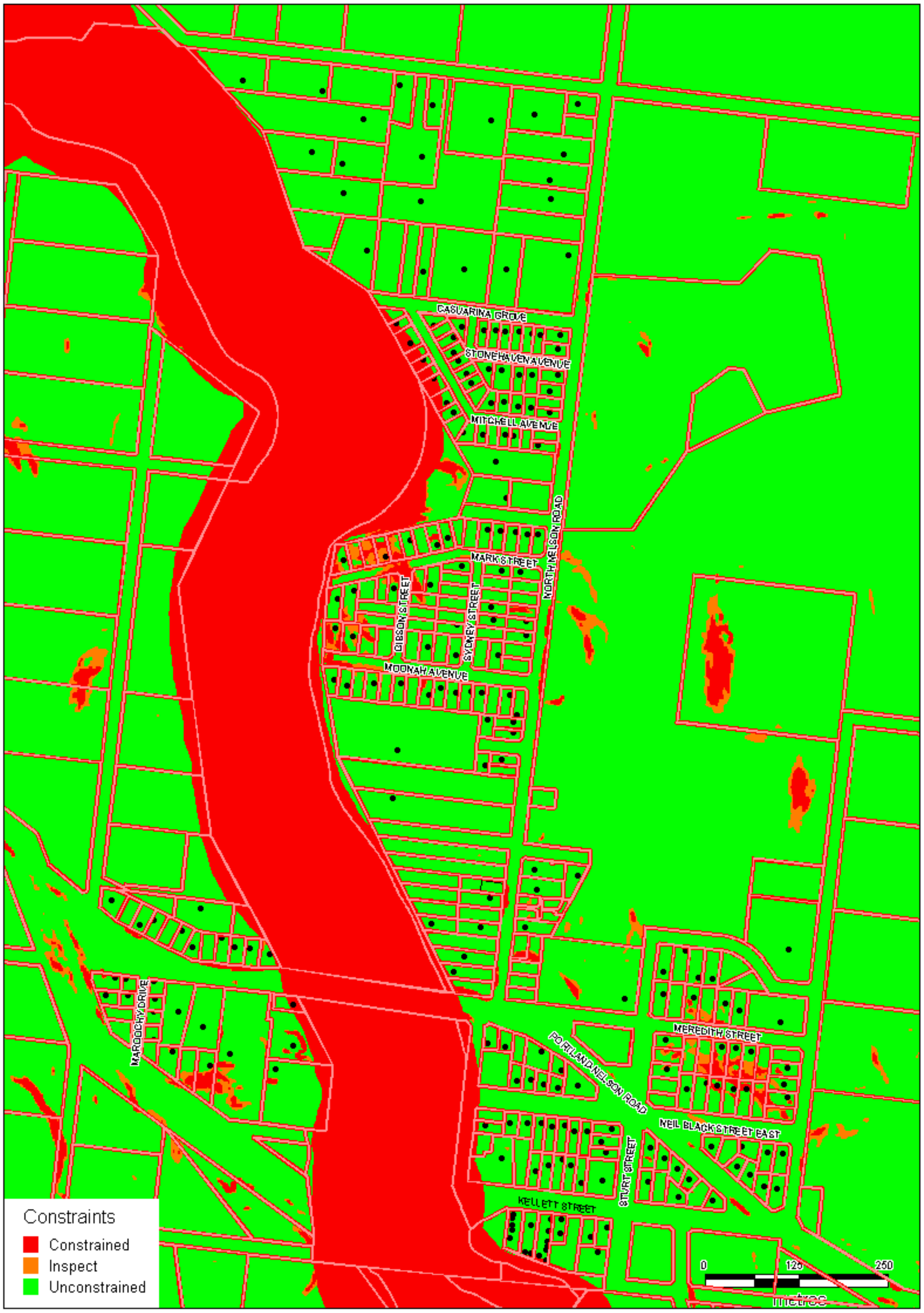
[2] Areas representative of a wastewater field-of-influence (eg adjoining titles not separated by a road reserve and on the same soil type) form the basis of maps 3 thru 5.

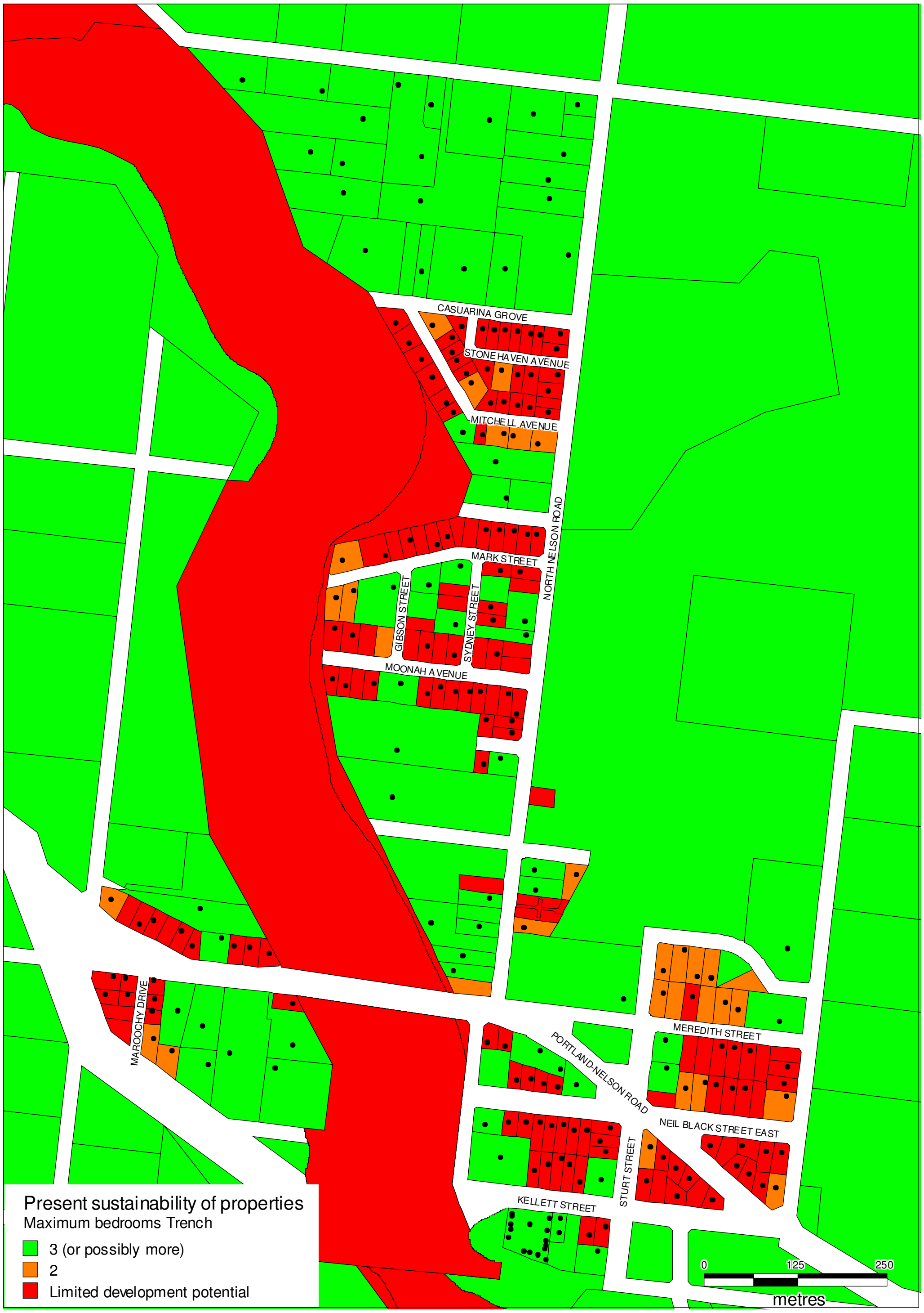
[3] Areas representative of a wastewater field-of-influence form the basis of maps 3 thru 5. Each area was related to the AS/NZS soil category disposal area requirements, and allowing 450m^2 of impervious surfaces for existing (or potential) development, the average sustainable bedrooms for that area was calculated. Constraints in map 6 are not considered. Only areas with dwellings are shaded. Dots represent dwelling locations.

Map 4: Potential sustainability if Nelson were to be fully developed using trench technology. The map assumes that each parcel has a dwelling using an all-waste system and a dosing pump. It does not consider the constraints shown in Map 6. It takes into account the absorption field recommendations for AS/NZS category 1 soils in table 6 of the report introduction, and an allowance of 450m^2 for impervious surfaces. Some areas that are sustainable at present would not be if fully developed using trench systems. The area in Kellett Street has changed status because the map does not reflect non-domestic wastewater circumstances.

Map 5: Potential sustainability of irrigation systems in areas within a fully developed Nelson. It takes into account the absorption field recommendations for AS/NZS category 1 soils in table 3, an allowance of 450m^2 for impervious surfaces, and ignores the constraints shown in Map 6. Most of Nelson would benefit from a change to irrigation technology over time. However the area surrounding Mitchell Avenue and south of Casuarina Grove remains a concern. It is near-fully developed and the many of the blocks are around 500m^2.



Map 6: Slope and stream buffer constraints in relation to properties and parcels. Some dwellings around Mitchell Avenue and Mark Street are constrained. The Code prohibits the consideration of land for wastewater absorption fields if it is within 60m of a river, has steep slopes, or is within 3 metres of an adjacent allotment for pressurised trench systems (red buffer), or 1.5 metres of an adjacent allotment for irrigation systems (pink buffer). Slopes are shown as three classes (0-17% is unconstrained, 18-22% requires inspection and >22% is constrained). Dots represent dwelling locations.



Map 7: Present sustainability for properties using trench systems. The map incorporates a reserve field and assumes that each dwelling would use an all-waste system and a dosing pump. It takes into account the absorption field recommendations for AS/NZS category 1 soils in table 6 of the report introduction, an allowance of 450m^2 for impervious surfaces, and the constraints shown in map 6. Clusters of developed properties with limited development potential suggest that there are probably already wastewater problems in the town.[4] The area in Kellett Street is a caravan park and falls outside the scope of this study.

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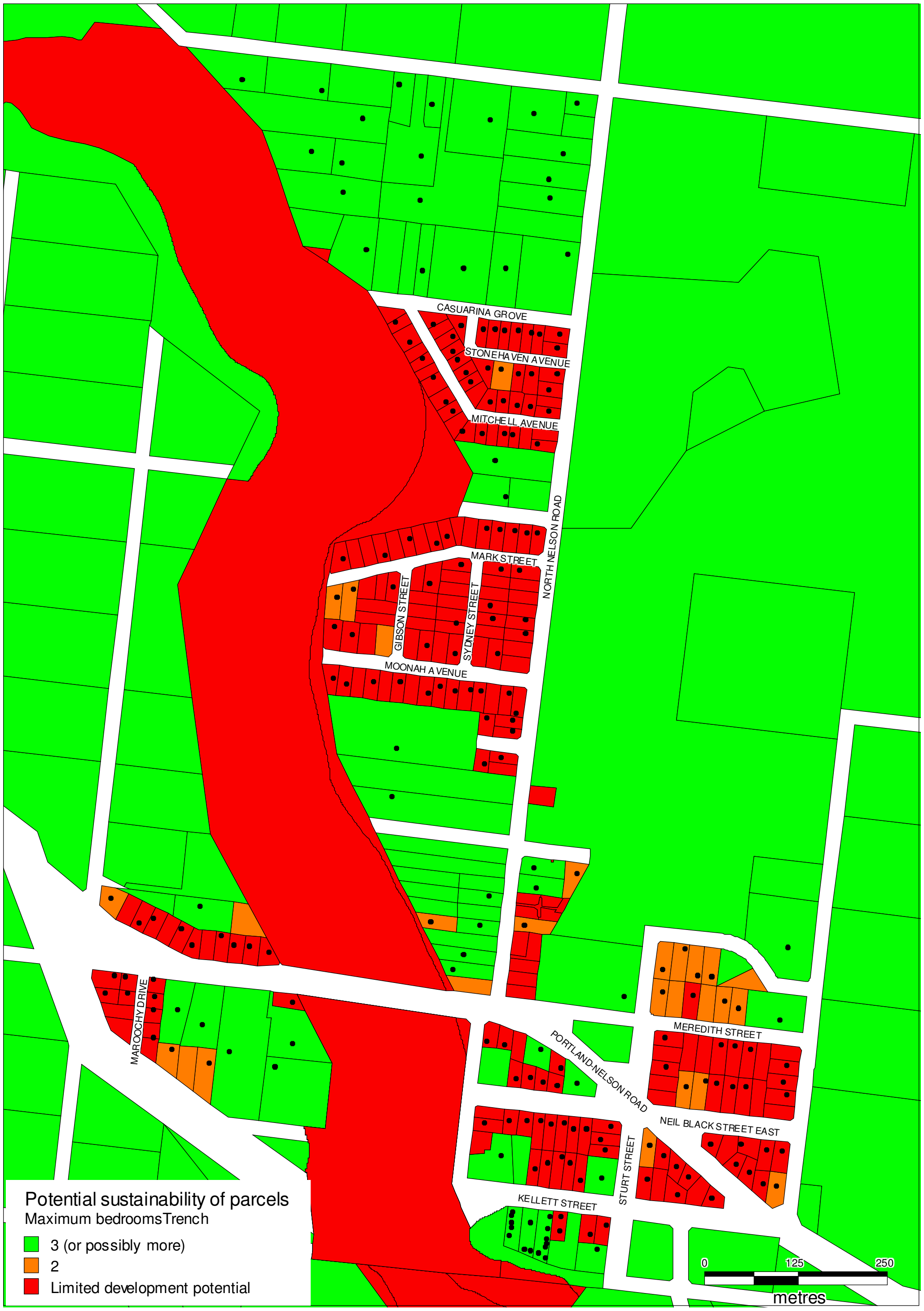
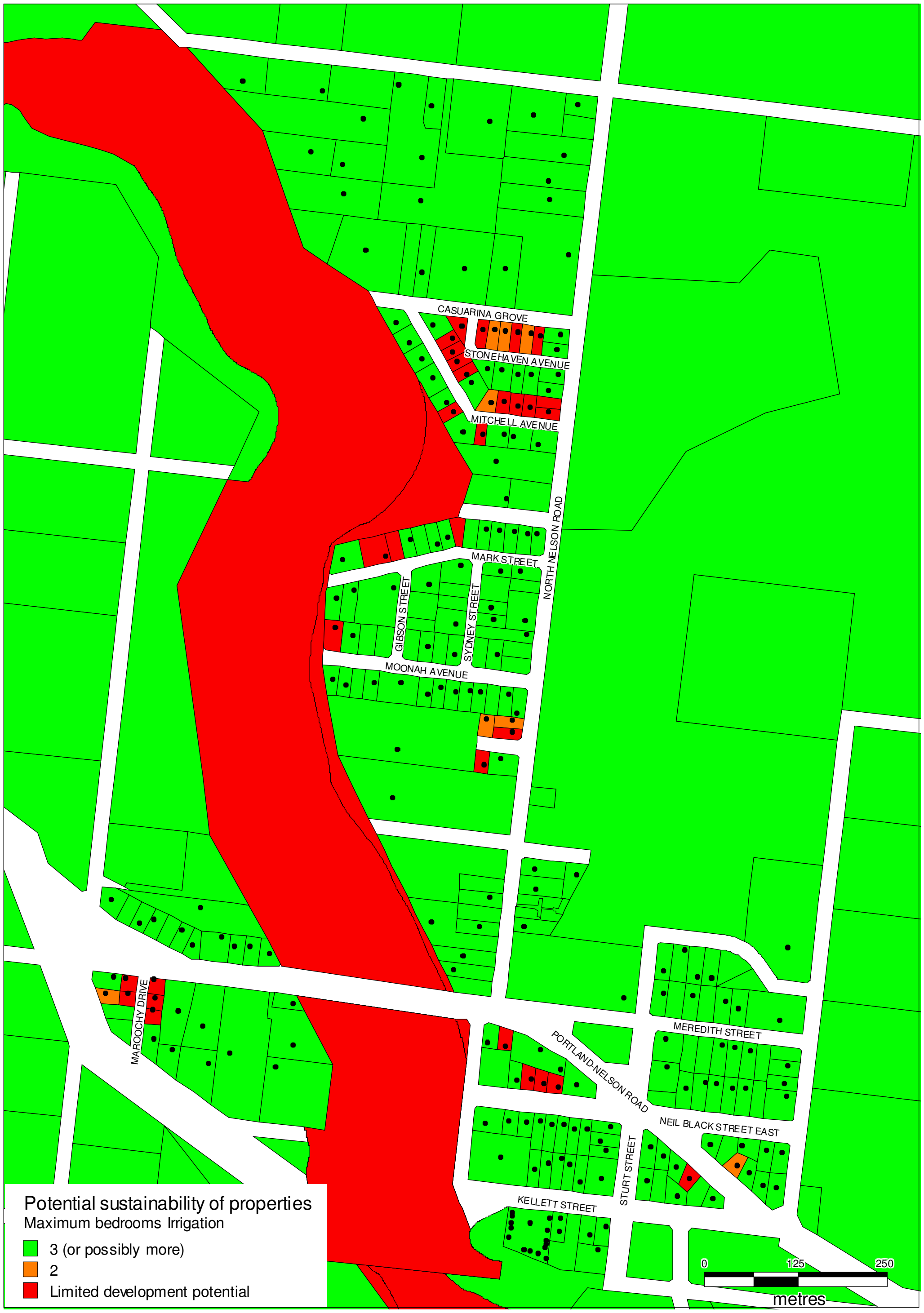
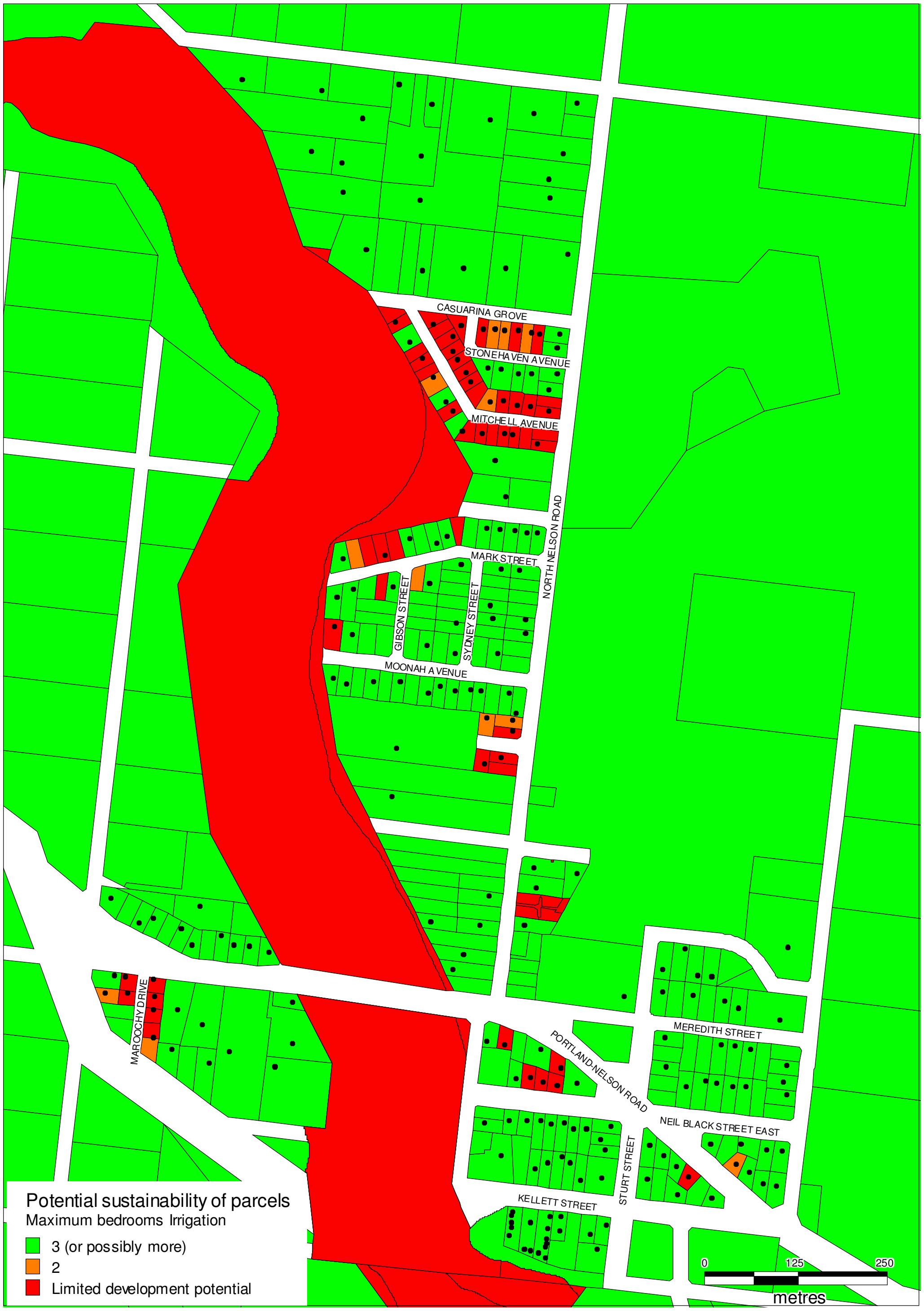
[4] In maps 7 thru 10, a block's sustainability reflects the likely size of its wastewater disposal envelope, and is expressed as Maximum Number of Bedrooms. The calculation takes into account the disposal area requirements for the AS/NZS soil category, a 450m^2 impervious surfaces allowance, and all of the constraints shown in map 6. Dots represent dwelling locations.



Map 8: Potential sustainability for parcels using trench systems on AS/NZS category 1 soils. It takes into account the absorption field recommendations for AS/NZS category 1 soils in table 6 of the report introduction, an allowance of 450m^2 for impervious surfaces, and the constraints shown in map 6. The map incorporates a reserve field and assumes that each dwelling would use an all-waste system and a dosing pump. This is map of onsite system sustainability should each parcel be developed and indicates that severe problems might emerge if Nelson was to be fully developed using traditional trench technologies. The area in Kellett Street is a caravan park and falls outside the scope of this study. Dots represent dwelling locations.



Map 9: Potential sustainability for properties using irrigation systems. It takes into account the absorption field recommendations for AS/NZS category 1 soils in table 3, an allowance of 450m^2 for impervious surfaces, and the constraints shown in map 6. If upgraded to irrigation systems, there are only a few small clusters of properties that remain unable to deal with wastewaters onsite, most of which are already developed. The area in Kellett Street is a caravan park and falls outside the scope of this study. Dots represent dwelling locations.



Map 10: Potential sustainability for parcels using irrigation systems. It takes into account the absorption field recommendations in for AS/NZS category 1 soils in table 3, an allowance of 450m^2 for impervious surfaces and constraints in map 6. Compared to map 9, there are only a few additional parcels that would be unable to deal with wastewaters onsite and most of these are already developed. The area in Kellett Street is a caravan park and falls outside the scope of this study. Dots represent dwelling locations.