BAY OF PLENTY REGIONAL COUNCIL
SIGNIFICANT GEOTHERMAL FEATURES (SGF) ASSESSMENT: STAGES 1 AND 2

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Project Team:
Kelvin Lloyd - Report author
Sarah Beadel - Peer review, report author
William Shaw - Peer review

Prepared for:
Bay of Plenty Regional Council
P.O. Box 364
Whakatāne

99 SALA STREET, WHAKAREWAREWA, 3010, P.O. BOX 7137, TE NGAE, ROTORUA 3042
Ph 07-343-9017; Fax 07-343-9018, email ecology@wildlands.co.nz, www.wildlands.co.nz

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Reviewed and approved for release by:

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Sarah Beadel
Director
Wildland Consultants Ltd

1. INTRODUCTION

Bay of Plenty Regional Council (BOPRC) wishes to reassess the significance of geothermal vegetation features (SGF) within the Bay of Plenty Region based on Criteria 7.12-7.21 in Appendix F of the Bay of Plenty Regional Policy Statement (RPS; Appendix 1). The significance criteria could be interpreted in a number of ways, and this inconsistency would be undesirable. BOPRC therefore requires a process to be outlined that would improve consistent interpretation of the criteria. The guidance must be clear and repeatable.

There are three stages to the work proposed:

- *Stage 1*: Methodology for reassessing the significance of previously identified significant geothermal vegetation using criteria from the Operative RPS.
- *Stage 2*: Desktop assessment of the methodology using existing site information.
- *Stage 3*: SGF statutory support.

This report addresses Stages 1 and 2.

The Appendix F criteria are known as 'Set 7' in the RPS, and apply to geothermal habitat only, while RPS Set 3 has mostly similar criteria and covers all kinds of habitat. The main difference between Set 3 and Set 7 is that Set 3 includes a distinctiveness criterion that is not contained in Set 7. If assessed under Set 3, all areas of geothermal habitat would be assessed as significant, because all would meet this distinctiveness criterion.

All geothermal sites are assessed in this report against Set 7 and the level of significance for each site has also been assessed.

2. METHODS

Stage 1

Recently-developed processes for assessing ecological significance in New Zealand were reviewed. Information on geothermal vegetation, habitats, and species, was also reviewed to help determine characteristic geothermal species and vegetation types. The BOBRC significance criteria were assessed for structure, logic, and clarity, and whether they were mutually exclusive or overlapped in coverage.

Stage 2

A methodology for ranking of significance assessments to enable each site to be assessed as being of National, Regional or Local significance was developed.

Sixty-seven sites previously identified in Wildland Consultants (2005) (including 20 sites listed in Appendix 2 that were not assessed in detail either through lack of information or lack of surface vegetation), and one site newly identified in 2010, have been assessed for significance and level of significance using the methodology developed above to determine significance status of each site according to the

operative Bay of Plenty RPS and the ranking system. Recent information on sites was used where available, e.g. sites in the Rotorua Lakes District visited as part of the District Plan process, sites in the eastern Bay of Plenty visited for monitoring, sites visited during a recent Rotorua Botanical Society field trip, and sites for which restoration plans have recently been prepared.

A list of all sites still considered to be significant is provided.

In conjunction with the above, the 2010 GIS layer of site boundaries held by the Regional Council was reviewed (at a scale of 1:5,000) using 2011 aerial photography[1]. Site boundaries were updated as a desktop exercise, and incorporating any available information from field inspections between 2010 and 2016 to provide a record of the area that was assessed against the criteria. Site boundary updates included both boundary changes as a result of better quality aerial photographs, increases in knowledge, and real increases and decreases in extent of geothermal areas. Extent of sites is discussed in Section 5 below.

3. ASSESSMENT OF SIGNIFICANCE

Ecological significance does not relate to the size of the class, but concerns the values of the attributes that are shared by members of the class[2]. Significance does not therefore relate to a fixed proportion of sites, but to sites which exceed the threshold of significance, regardless of how many or few there are. It is important therefore that thresholds of significance for each significance criterion are easily evaluated using site information. Ideally, all criteria should be able to be assessed objectively, but some criteria, such as ecological context, have wide scope and inevitably require the expert judgement of an ecologist.

The BOPRC significance criteria are somewhat wordy, and could be made more concise without losing their meaning. For example, every criterion repeats the phrase *"indigenous vegetation or habitat of indigenous fauna on a geothermal area*". This could be stated once as the scope of all criteria, rather than being repeated in each one. Several criteria appear to be redundant, as the matters they address are included in other criteria. If significance is achieved by high rankings for one or more of the BOPRC criteria, then this problem of criteria that duplicate each other could be avoided. The criteria set should be reviewed and amended at the earliest opportunity.

For criteria such as representativeness, the assessment of significance relies on standards of characteristic geothermal vegetation and habitat structure and composition, and geothermal processes. Similar standards are used to assess wetland vegetation and habitats in the West Coast Region[3], and in guidelines for the assessment of ecological significance in the Canterbury Region (Wildland Consultants 2013). In addition, the assessment needs to be undertaken at the scale of the Taupo Volcanic Zone and the indigenous vegetation and habitats within this zone. Information in Tables 1 and 2 can be used to develop these standards, as they describe

1 2011 photographs are the most recent available.
2 Interim decision of the Environment Court (2010), NZEnvC 345, Paragraph 42.
3 Interim decision of the Environment Court (2010), NZEnvC 345, Paragraphs 32-49.

characteristic geothermal habitat, vegetation, and plant species within the Taupo Volcanic Zone.

Note that Table 1 does not necessarily include every detailed vegetation/habitat type found in geothermal areas, especially in the Waikato Region. There are many species combinations, and variations in ground temperatures, sometimes in relatively small areas, resulting in much variation in vegetation composition. It must also be noted that the terrestrial habitats in Table 1 are based on ground temperatures that range from cooler (but still warm) to very hot. There are many species, and species combinations, that occur on cool ground on the margins of geothermal sites and many geothermal sites contain ground that was recently hot but is now cold, and vice versa. For these reasons the assignment of geothermal habitat to vegetation/habitat types represents the typical situation, but exceptions do occur.

Table 1: Structure, composition, and geothermal influence of typical geothermal vegetation and geothermal habitat within the Taupo Volcanic Zone[1].

Geothermal Habitat[2]	Vegetation	Structure and Composition
Geothermal water, including hot springs	Geothermal water bodies and streams	Water temperature and/or chemistry altered by geothermal processes.
Very hot ground with regular sinter deposits.	Sinter pavement	No plant cover.
Bare areas too hot or too disturbed to support plant life. Associated with steam vents, boiling mud craters, fumeroles, and very hot soils.	Non-vegetated raw soilfield	Less than 1% plant cover.
Hot soils that do not support vascular plant life.	Mossfield	Dominated by species of *Campylopus*, with scattered crustose lichens, and occasional *Lycopodiella cernua*.
Fumeroles and their margins.	Mixed fernland	Combinations of *Dicranopteris linearis*, *Histiopteris incisa*, *Hypolepis dicksonioides*, *Lycopodiella cernua*, and bracken. Karamu and turutu are sometimes present.
Hot riparian sites and springs, generating steamy conditions.	*Christella* fernland	Dominated by *Christella* aff. *dentata* (b) (AK126902). The ferns *Deparia petersenii* and *Diplazium australe* are often present.
Geothermally-heated sandfield	Unvegetated sandfield	Geothermally heated sandfield. Hot water present under the sand on beaches, unvegetated.
Steam vents	Pōhutukawa, kānuka forest.	Pōhutukawa and/or kānuka common. Some patches of *Psilotum nudum* in understorey.
Hot ground	Geothermal kānuka shrubland	Low-growing, scattered geothermal kānuka shrubs are the only woody species, with occasional *Lycopodiella cernua*, *Cheilanthes sieberi*, and *Psilotum nudum*. Occasional monoao and mingimingi are present with rare *Calochilus robertsonii*.
	Kunzea salterae shrubland	Low-growing *Kunzea salterae* with scattered plants of mingimingi, arching clubmoss, turutu, and *Psilotum nudum*
	Campylopus mossfield	Dominated by species of *Campylopus*, with scattered crustose lichens.

[1] Vegetation/habitat classification is modified and expanded from Merret and Clarkson (1999).

[2] Generally ordered in relation to decreasing substrate temperatures (exceptions are geothermally-heated sandfield and steam vents).

Geothermal Habitat[2]	Vegetation	Structure and Composition
Moderately hot ground	Geothermal kānuka scrub	Dense geothermal kānuka with occasional monoao and mingimingi. Ground cover includes bryophytes and occasional *Psilotum nudum*, with *Dicranopteris linearis*, *Nephrolepis flexuosa*, and *Lycopodiella cernua* on margins
	Kunzea salterae scrub	Dense *Kunzea salterae* with scattered patches of pōhutukawa, mingimingi, turutu, and water fern, are also common. Patches of *Psilotum nudum*.
	Campylopus mossfield	Dominated by species of *Campylopus*, with scattered crustose lichens.
Warm ground	Geothermal kānuka-mingimingi scrub	Geothermal kānuka and mingimingi 1-2 tall co-dominate, can have patches of *Dicranopteris linearis*, tangle fern, hard fern, and bracken on margins.
	Gleichenia fernland	Usually dominated by *Gleichenia microphylla*, sometimes with *Psilotum nudum* beneath the fern canopy.
Warm swampy ground	*Cyclosorus* fernland	Dominated by *Cyclosorus interruptus*
	Mānuka scrub and shrubland	Dominated by mānuka above ferns and sedges, sometimes with *Machaerina arthrophylla*, giant umbrella sedge.
	Mixed fern, sedge shrubland	Mixture of ferns and sedges which can include waterfern, *Hypolepis ambigua*, *Machaerina arthrophylla,* ring fern, *M. rubiginosa*.
	Giant umbrella sedge-dominant sedgeland	Giant umbrella sedge with local toetoe (*Austroderia fulvida)* and *Juncus edgariae*.
	Raupō, *Carex secta*	Raupō and/or *Carex secta*-dominant, with local *Cyclosorus interruptus*.
Warm ground, banks, and shrubland margins	*Dicranopteris* fernland	Dominated by *Dicranopteris linearis*
Open warm ground, steam-influenced sites, shrubland margins	*Nephrolepis* fernland	Dominated by *Nephrolepis flexuosa*
Cooler hydrothermally-altered soils	Mingimingi-mānuka shrubland	Shrubland 2-4 m tall, dominated by mingimingi and mānuka, with occasional monoao, *Cyathodes juniperina*, turutu, geothermal kānuka.
	Mingimingi-mānuka-kānuka scrub	Similar to above, with kānuka (*Kunzea robusta*) in canopy, local geothermal kānuka.
	Mingimingi scrub	Dense mingimingi shrubs to 2 m tall, with occasional monoao, mānuka, geothermal kānuka.
	Monoao scrub	Dominated by monoao with occasional geothermal kānuka and mingimingi, and a dense lichen ground cover.
	Kānuka-dominant forest and scrub	Dominated by kānuka, sometimes with mānuka and/or mingimingi and/or geothermal kānuka, with turutu, mingimingi, water fern, and local tangle fern in the understorey.
	Mixed fernland	Ferns such as *Hypolepis ambigua*, *Histiopteris incisa*, wheki present.
	Geothermal kānuka scrub and shrubland	Scrub and shrubland characterised by geothermal kānuka with, in placed, local mingimingi, turutu, bracken, and mānuka.
	Pohutukawa-dominant forest	Pohutukawa × northern rata, pohutukawa, and occasionally kamahi form the canopy. Understorey can include water fern, mingimingi, mānatu, bracken, turutu, *Hypolepis distans*. Geothermal kānuka locally common.
Cooler/cool wetland	Mānuka-dominant scrub	Occasional cabbage tree occur over mānuka scrub. *Machaerina rubiginosa* and swamp coprosma are common in the understorey. Other species present include *Machaerina articulata*, *M. teretifolia,* and *M. juncea.* Several small areas of raw-soilfield area present.

Geothermal Habitat[2]	Vegetation	Structure and Composition
Cool wetland	Wheki/*Machaerina rubiginosa*-kiokio sedgeland	Wheki is emergent over *Machaerina rubiginosa* with locally common *Carex geminata*, *Hypolepis distans*, bracken, *Juncus edgariae*, and sphagnum.
	Carex secta, raupō	*Carex secta* and/or raupō are dominant, with local *Schoenoplectus tabernaemontani*.

Forty-nine characteristic geothermal plant species (Wildland Consultants 2015) are listed in Table 2. One of these species is classified as Threatened-Nationally Critical, two are classified as At Risk-Declining, and 14 are classified as At Risk-Naturally Uncommon (de Lange *et al.* 2013).

Table 2: Characteristic geothermal plant species in the Taupo Volcanic Zone.

Species	Common Name	Threat Status
Blechnum parrisiae		
Caladenia alata		At Risk-Naturally Uncommon
Caladenia atradenia		At Risk-Naturally Uncommon
Caladenia minor		Threatened-Nationally Critical
Calochilus paludosus		At Risk-Naturally Uncommon
Calochilus robertsonii		At Risk-Naturally Uncommon
Camphylopus spp.		
Carex geminata		
Carex secta		
Cheilanthes sieberi var. *sieberi*	Rock fern	Not Threatened
Christella aff. *dentata* (b) (AK126902 "thermal")		At Risk-Naturally Uncommon
Coprosma repens	Taupata	Not Threatened
Corunastylis pumila	Red leek orchid	At Risk-Naturally Uncommon
Cyathodes juniperina	Prickly mingimingi	
Cyclosorus interruptus		At Risk-Declining
Cyperus ustulatus f. *ustulatus*		Not Threatened
Dianella haematica		Not Threatened
Dianella nigra	Turutu	Not Threatened
Dicranopteris linearis var. *linearis*		At Risk-Naturally Uncommon
Dracophyllum subulatum	Monoao	Not Threatened
Drosera auriculata		
Fimbristylis velata		At Risk-Naturally Uncommon
Gleichenia microphylla	Tanglefern	Not Threatened
Gonocarpus incanus		
Histiopteris incisa	Water fern	Not Threatened
Hypolepis ambigua		Not Threatened
Hypolepis dicksonioides		At Risk-Naturally Uncommon
Hypolepis distans		
Isolepis cernua var. *cernua*		Not Threatened
Juncus krausii	Sea rush	Not Threatened
Korthalsella salicornioides		At Risk-Naturally Uncommon
Kunzea robusta	Kānuka	Not Threatened
Kunzea salterae		At Risk-Naturally Uncommon
Kunzea serotina	Kānuka	Not Threatened
Kunzea tenuicaulis	Geothermal kānuka	At Risk-Naturally Uncommon
Leptospermum scoparium var. *scoparium*	Mānuka	Not Threatened
Leucopogon fasciculatus	Mingimingi	Not Threatened
Lycopodiella cernua		Not Threatened
Machaerina arthrophylla		Not Threatened
Metrosideros excelsa	Pōhutukawa	Not Threatened
Nephrolepis flexuosa	Native ladder fern	At Risk-Declining
Psilotum nudum	Whisk fern	Not Threatened
Pteridium esculentum	Bracken	Not Threatened
Schizaea bifida	Forked comb fern	Not Threatened
Schizaea dichotoma	Fan fern	At Risk-Naturally Uncommon
Schoenoplectus tabernaemontani		

Species	Common Name	Threat Status
Thelypteris confluens	Swamp fern	At Risk-Naturally Uncommon
Triglochin striata	Arrow grass	Not Threatened
Typha orientalis	Raupo	

The BOPRC criteria, a rationale for assessing them, and a process for assessing significance, are listed in Table 3. A High-Moderate-Low framework was used for most criteria, but for some criteria, a 'meets threshold'/'does not meet threshold' framework was used. Where possible, thresholds between different ranks have been defined objectively to facilitate consistent interpretation of criteria, but these thresholds are arbitrary.

We suggest that a 'one or more' approach is used to assess significance using the BOPRC criteria set, thus any site that has a High ranking (Table 3) for any one of Criteria 7.12-7.15 or 7.17-7.21 should be considered to be significant, or where a site has several (e.g. four or more) moderate rankings (for Criteria 7.12-7.15 or 7.17-7.21), it could also be considered to be significant. As the Viability, Sustainability, and Aesthetic Value criteria (7.19-7.21) essentially duplicate the Representativeness assessment (all relate to the intactness or naturalness of a site), they can be assessed, but should not be double-counted in the assessment of significance.

Sixty-nine[1] sites in the Bay of Plenty have been assessed using this assessment process, and the results of this assessment are presented in Appendix 2 and summarised in Table 4.

Forty-three of the 47 geothermal sites in the Bay of Plenty that were previously identified and assessed as of significance (see Wildland Consultants 2005 and one site newly identified in 2010) were determined to meet the BOPRC criteria for significance.

The 20 sites listed in Appendix 2 of Wildland Consultants 2005 which were not previously assessed against the BOPRC criteria for significance, either through lack of information or lack of surface vegetation, were assessed based on existing information, and ten were found to be significant, generally because they were within larger significant natural areas. The remaining ten were found not to be significant.

One new site was assessed and this was found to be significant.

[1] Papakiore 19A and 19B counted as one site.

Table 3: Bay of Plenty Regional Policy Statement Appendix F Set 7 significance criteria, and a process for their assessment.

BOPRC Criteria	Rationale	Significance Assessment Process
Representativeness		
7.12 The extent to which indigenous vegetation or habitat of indigenous fauna on a geothermal area contributes to the full range of associations of indigenous species representative, typical, or characteristic of the natural biodiversity of the geothermal resource of the Taupo Volcanic Zone.	To assess this criterion, the composition, structure, and geothermal influence of typical, characteristic geothermal vegetation and geothermal habitats needs to be known and understood in relation to geothermal processes. As geothermal vegetation and habitat has been described at a coarse level (Merrett & Clarkson 1999) these units could be considered to represent the different geothermal vegetation and habitat types. For each of these types, the composition, structure, and geothermal influence of the most intact remaining examples of geothermal vegetation and habitat in the Taupo Volcanic Zone (Table 1) could be used to define thresholds of significance. Representativeness is important as it is the only criterion which ensures that the full range of typical or characteristic indigenous vegetation and habitat will be captured.	• **High** - the vegetation or habitat is consistent with one of the descriptions in Table 1. The listed indigenous canopy species are abundant (>75% of the vegetation cover), characteristic plant species (Table 2) make up at least 75% of the flora, and the relevant geothermal influence (e.g. warm ground) for that vegetation/habitat type is present. • **Moderate** - the listed indigenous canopy species are present, but at lower abundance, characteristic species make up 50-74% of the flora, the relevant geothermal influence (e.g. warm ground) for that vegetation/habitat type is present. • **Low** - the key indigenous canopy species are absent or scarce, characteristic species make up <50% of the flora, the relevant geothermal influence (e.g. warm ground) for that vegetation/habitat type is diminished or absent.
Diversity and Pattern		
7.13 The extent to which indigenous vegetation or habitat of indigenous fauna on a geothermal area contains a high diversity of indigenous ecosystem or habitat types, or changes in species composition, reflecting the existence of diverse natural features (for example landforms, soil types, or hydrology) or communities along an ecological gradient (e.g. a soil temperature gradient)	As diversity and pattern relates to the number of different species and habitats, Tables 1 and 2 can also be used to help determine thresholds of ecological significance for this criterion.	• **High** - At least five geothermal vegetation types (Table 1) OR at least eight characteristic plant species (Table 2) OR at least five geothermally-influenced habitat types (Table 1) are present OR a geothermal gradient involving at least three geothermal vegetation types is present. • **Moderate** - 3-4 geothermal vegetation types or 5-7 characteristic plant species OR at least three geothermally influenced habitat types present OR a gradient between two geothermal vegetation types is present. • **Low** - One or two geothermal vegetation types, fewer than five characteristic plant species, 1-2 geothermally influenced habitats and no geothermal gradients are present.
Rarity		
7.14 The extent to which indigenous vegetation or habitat of indigenous fauna on a geothermal area supports an indigenous species or	The threat classification system of Townsend *et al.* (2008) should be used for national scale species rarity. Current assessments for different groups under this system include: • de Lange *et al.* (2013) for vascular plants	• **High** - A Threatened or At Risk-Declining species OR Five or more At Risk (categories other than Declining) or regionally rare species OR one of the largest populations of an At Risk or regionally rare species are resident within the geothermal site, OR at least

BOPRC Criteria	Rationale	Significance Assessment Process
associations of species threatened or rare nationally or regionally. NB the relative significance would be judged on the number of such species present and their threat status.	• Robertson *et al.* (2013) for avifauna • Glenny *et al.* (2011) for mosses • de Lange *et al.* (2015) for hornworts and liverworts • de Lange *et al.* (2012) for lichens Regionally rare species: Indigenous plant species and indigenous fauna that are permanently resident within geothermal sites should have lower thresholds of significance compared to mobile indigenous fauna which may use geothermal sites only occasionally. Williams *et al.* (2007) lists historically rare ecosystems, and Holdaway *et al.* (2012) classifies them according to threat status. Under the latter classification, fumaroles, geothermal stream sides, geothermal heated ground, and geothermal hydrothermally altered ground all have the status of Threatened-Critically Endangered.	two Critically Endangered geothermal ecosystems are present. • **Moderate** - At least one At Risk or regionally rare species are resident within the geothermal site, OR at least one Critically Endangered geothermal ecosystem is present. • **Low** - No Threatened or At Risk species. No Critically Endangered geothermal ecosystems are present. Two or few regionally rare species are resident.
Distinctiveness		
7.15 The extent to which indigenous vegetation or habitat of indigenous fauna on a geothermal area is one of the largest remaining examples of its type within the Taupo Volcanic Zone	This assessment utilises mapping of geothermal areas within the Taupo Volcanic Zone. Sites would qualify if they were large examples of geothermal complexes or large examples of geothermal vegetation and habitat types.	• **High** - The geothermal site or a geothermal vegetation or habitat type is one of the largest examples of its type. • **Moderate** - The geothermal site or a geothermal vegetation or habitat type is a moderate-sized example of its type. • **Low** - The geothermal site or a geothermal vegetation or habitat type are small-sized examples of their type.
7.16 The extent to which indigenous vegetation or habitat of indigenous fauna on a geothermal area is significantly reduced in area and is degraded but retains key ecosystem functions (for example hydrology).	This criterion aims to capture sites with degraded vegetation and habitat but which still have ecosystem functions	• **Meets threshold (High)** - Indigenous vegetation or habitat is degraded but the site retains a key ecosystem function. • **Does not meet threshol**d (low) - Indigenous vegetation or habitat is degraded but the site does not retain any key ecosystem functions.
Ecological Context		
7.17 The extent to which indigenous vegetation or habitat of indigenous fauna on a geothermal area contributes to the ecological viability	This criterion is context-dependent, and would require the expert judgement of an ecologist.	• **High**- The geothermal site adjoins a natural area and is an important component of a network of indigenous habitat patches, OR provides an important corridor for the movement of indigenous

BOPRC Criteria	Rationale	Significance Assessment Process
of adjoining significant natural areas and biological communities, by providing or contributing to an important ecological linkage or network, or providing a buffer from adjacent land uses.		fauna, OR helps to buffer an important lake, wetland, or stream, OR buffers a significant adjacent natural area. • **Moderate** - The geothermal site is part of a network of indigenous habitat patches OR provides a moderately important corridor for the movement of indigenous fauna, OR helps to buffer a moderately important lake, wetland, or stream, OR buffers a moderately important adjacent natural area. • **Low** - The geothermal site is not an important component of a network of indigenous habitat patches, does not provide an important corridor for the movement of indigenous fauna, and does not help to buffer an important lake, wetland, or stream or important adjacent natural areas.
7.18 The extent to which indigenous vegetation or habitat of indigenous fauna on a geothermal area provides habitat for threatened indigenous species at key stages of their life cycle.	As written, the scope of this criterion is restricted to threatened indigenous species, which is a significant limitation. In most criteria sets, a similar criterion applies to all indigenous fauna, including common species, so long as the site provides important habitat. Key stages of life cycles generally apply to indigenous fauna (e.g. feeding, breeding, resting, and refuges from predation). For plants, the entire life cycle is almost always present at the site.	• **High** - The site is important for feeding, breeding, resting, or provides a refuge from predation for at least one Threatened species of indigenous fauna. • **Moderate** - The site is important for feeding, breeding, resting, or provides a refuge from predation for at least one At Risk species of indigenous fauna. • **Low** - The site is not important for feeding, breeding, resting, or providing a refuge from predation, for Threatened or At Risk species of indigenous fauna.
Viability and Sustainability		
7.19 The extent to which indigenous vegetation or habitat of indigenous fauna on a geothermal area is of sufficient size and compact shape and that it has the capacity to maintain its ecological viability over time, to adapt to natural changes and resist changes initiated by external agents.	Viability has generally been deleted from second generation significance criteria sets, as it relates to management, which is not an intrinsic value of a site. Size and shape can influence ecological processes such as edge effects (e.g. habitat for edge species, provision of 'core' habitat), but it is not known whether these are important to geothermal habitats. Geothermal sites are or were determined by geothermal activity. Maintenance of these geothermal conditions is the strongest factor affecting the viability of geothermal sites. Weed invasion is another factor that affects the viability of geothermal vegetation on hydrothermally-influenced cooled geothermal soils. This criterion is thus best used to assess sites which are little altered by effects on geothermal activity and weeds, but as these factors affect the structure and	• **High** - The geothermal site is large and compact and has not been affected by artificial alteration of geothermal processes, or other artificial impacts such as vegetation clearance or modification of substrate, and no exotic-dominant vegetation is present. • **Moderate** - The geothermal site is of moderate size and compactness and is moderately affected by artificial alteration of geothermal processes, or other artificial impacts such as vegetation clearance or modification of substrate, and/or has exotic-dominant vegetation cover of no more than 5%.

BOPRC Criteria	Rationale	Significance Assessment Process
	composition of geothermal vegetation and habitats, this assessment will essentially duplicate the representativeness assessment and result in double-counting of site values. Exotic-dominant vegetation can be identified on existing vegetation maps of geothermal sites.	• **Low** - The site is small and mostly linear and has been strongly affected by artificial alteration of geothermal processes, or other artificial impacts such as vegetation clearance or modification of substrate, and/or has an exotic-dominant vegetation cover over more than 5% of the site.
7.20 The extent to which indigenous vegetation or habitat of indigenous fauna on a geothermal area supports intact habitats and healthy functioning ecosystems.	Similar to the above, intactness and ecosystem health are attributes that are captured by the representativeness criterion. If integrity of geothermal activity and indigenous dominance were used as indices of ecosystem health and functioning, the assessment would be very similar to that for Criterion 7.19. This would represent triple counting of the same site values.	• **High** - The geothermal site is intact and healthy. It has not been affected by artificial alteration of geothermal processes, or other artificial impacts such as vegetation clearance or modification of substrate, and no exotic-dominant vegetation is present. • **Moderate** - The geothermal site is moderately intact and healthy. It has been moderately affected by artificial alteration of geothermal processes, or other artificial impacts such as vegetation clearance or modification of substrate, and/or has exotic-dominant vegetation cover of no more than 5%. • **Low** - The site is highly modified. It has been strongly affected by artificial alteration of geothermal processes, or other artificial impacts such as vegetation clearance or modification of substrate, and/or has an exotic-dominant vegetation cover over more than 5% of the site.
Aesthetic Values		
7.21 The extent to which indigenous vegetation or habitat of indigenous fauna on a geothermal area is in a natural state or healthy condition, or is in an original condition.	This criterion again duplicates the representativeness criterion. It is very similar to Criterion 7.20. A healthy condition or original condition is best assessed by the structure and composition of indigenous vegetation and habitat. This is assessed under Criterion 7.12, which is repeated here.	• **High** - the vegetation or habitat is consistent with one of the descriptions in Table 1. The listed canopy species are abundant (>75% of the vegetation cover), characteristic plant species (Table 2) make up at least 75% of the flora, and the relevant geothermal influence is present. • **Moderate** - the listed canopy species are present, but at lower abundance, characteristic species make up 50-74% of the flora, the relevant geothermal influence is present • **Low -** the key canopy species are absent or scarce, characteristic species make up <50% of the flora, the relevant geothermal influence is diminished or absent.

Table 4: Sites in the Bay of Plenty assessed against Criteria Set 7 and for level of significance.

Table 4a: Sites mapped, described, and assessed in previous surveys.

Site		Significant (Set 7) Yes/No	Level of Significance
2	Taheke	Yes	National
3	Ōhinemutu	Yes	Regional
4	Kuirau Park	Yes	Regional
5	Sulphur Point	Yes	National
6	Old Government Gardens	Yes	Regional
7	Ngāpuna	Yes	National
8	Arawa Park Racecourse	Yes	Regional
9	Wonderland	Yes	Local
10	Arikikapakapa (Golf Course)	Yes	Regional
11	Tangatarua (Old Taupo Road Reserve)	Yes	Regional
12	Whakarewarewa	Yes	National
13	Redwood Grove Pool	Yes	Regional
14	Hells Gate	Yes	National
15	Tikitere Northwest	Yes	National
16	Otutarara Springs	Yes	Regional
17	Maraeroa	Yes	National
18	Ruahine Springs	Yes	National
19	Papakiore Springs 19A	Yes	National
	Papakiore Springs 19B	Yes	Local
20	Parengarenga Springs	Yes	National
21	Manupirua Hot Springs	Yes	Local
22	Tikitere Bore	No	N/A
25	Mokoia Island	Yes	National
26	Waimangu-Rotomahana	Yes	National
28	Tikorangi Central	No	N/A
29	Tikorangi South	Yes	National
30	Tikorangi North	Yes	Regional
31	Waitangi Soda Springs Mire	Yes	National
34	Waitangi Soda Springs Hot Springs	Yes	Regional
41	Te Rātā (Hot Water Beach)	Yes	National
42	Tarawera Rift	Yes	National
43	Parimahana	Yes	National
44	Parimahana Extension	Yes	Regional
45	Kawerau Township	Yes	Regional
56	Puhipuhi	No	N/A
57	Waiaute Springs	Yes	National
62	Te Weta Bay	No	N/A
63	Wharetata Bay	Yes	Local
64	Cemetery Reserve	Yes	Local
65	Puarenga Park (Soccer Park)	Yes	Regional
66	Government Gardens (including Rachel Springs)	Yes	Local
67	Pohaturoa	Yes	Local
68	Te Rei Bay	Yes	Local
70	Waimangu North	Yes	National
71	Tarawera River Geothermal Springs	Yes	National
55	Pukaahu Springs (Awakeri)	Yes	Regional
51	Maketū	Yes	National
54	Tukuri	Yes	Regional
53	Moutohoroa (Whale Island)	Yes	National

Table 4b: Sites not previously assessed in detail, either through lack of information or lack of surface information.

Site		Significant (Set 7) Yes/No	Level of Significance
1	Oira Bay, Tūhua (Mayor Island)	Yes	National
60	Moewai Bay, Tūhua (Mayor Island)	Yes	National
61	Orongatea Bay, Tūhua (Mayor Island)	Yes	National
23	Lake Rotoiti	Yes	Regional
24	Waikawa Springs (Lake Rotokawa)	No	N/A
27	Tikorangi 1	No	N/A
32	Otei Springs	No	N/A
35	Rotomā School Wetland	No	N/A
40	Mangakotukutuku Springs	No	N/A
36	Ōkataina	Yes	National
37	Humphreys Bay (Lake Tarawera)	Yes	National
38	Lake Tarawera (Western Shores)	Yes	National
46	Woodlands Hot Springs	No	N/A
47	Sapphire Hot Springs	No	N/A
48	Te Puna Spring	No	N/A
49	Mt Maunganui Hot Spring	No	N/A
50	Welcome Bay Spring	No	N/A
52	White Island (Whakaari)	Yes	National
72	Rūrima Island	Yes	National
58	Pukehinau Hot Springs	Yes	National
59	Manaohou Hot Springs	Yes	National

4. DEFINING NATIONAL, REGIONAL, AND LOCAL VALUE

The national, regional, or local value of a geothermal site can be assigned using criteria relating to protection status, size, representativeness, value for nationally Threatened taxa, or degree to which each of the significance criteria are met.

National, regional, and local significance would attach to sites meeting one or more of the following criteria:

NATIONAL significance would attached to sites meetings one or more of the following criteria:

CRITERIA		ASSESSMENT	
N1	The site is designated under international policy ratified by New Zealand, e.g. Ramsar, World Heritage, or the site lies within a national park or ecological area protected under the Conservation Act 1987		
N2	The site is within a larger natural area ranked in a previous study as of National significance.		
N3	The entire site (all vegetation units) rank 'high' for representativeness, and it is the one of the best or only remaining example of a geothermal vegetation/ habitat type.		
N4	The site is the largest good quality example of its type.		
N5	The site has a 'high' ranking for at least four of Criteria 7.12-7.15, 7.17-7.18, and is one of the largest remaining good quality examples of its type.		
N6	The site is an important site for a Nationally Threatened or At Risk-Declining species.		
N7	Contains one of the best (largest, most secure) populations of three or more At Risk species in geothermal areas.		
N8	Contains one of the best populations of a Threatened or At Risk plant species endemic to geothermal areas (e.g. *Kunzea tenuicaulis* or *K. salterae*).		

REGIONAL significance would attach to sites meeting one or more of the following criteria:

CRITERIA		ASSESSMENT
R1	The site is protected under the Reserves Act 1977.	
R2	The site is within a larger natural area ranked in a previous study as of Regional significance.	
R3	At least half of the site has vegetation units ranked 'high' for representativeness, and scores M or H for both 7.17 & 7.19.	
R4	The site is a large example of its type in the Region.	
R5	The site is an important site for an At Risk-Naturally Uncommon or regionally uncommon species	
R6	The site has a 'high' ranking for at least two of Criteria 7.12-7.15, 7.17-7.18.	

LOCAL significance would attach to sites meeting one or more of the following criteria:

CRITERIA		ASSESSMENT
L1	A site is **at least** of local significance if it has a High Ranking for any one Criterion 7.12-7.15 or 7.17-7.21 (in Table 3) OR several (e.g. four or more) moderate rankings for Criterion 7.12-7.15 or 7.17-7.18), OR a moderate ranking for Criteria 7.14.	
L2	The site lies within a larger natural area ranked in a previous study as of Local significance.	

Locally significant geothermal areas are examples of geothermal vegetation and/or habitat types. They are often smaller areas. These sites play an important part in a network of geothermal areas. Geothermal vegetation and habitat is limited in extent in New Zealand, covering less than 1,000 ha. Geothermal kānuka (an At Risk-Naturally Uncommon species) scrub and shrubland covers only *c.*300 ha.

Williams *et al.* (2007) lists historically rare ecosystems, and Holdaway *et al.* (2012) classifies them according to threat status. Under the latter classification, fumaroles, geothermal stream sides, geothermal heated ground, and geothermal hydrothermally altered ground all have the status of Threatened-Critically Endangered.

All locally significant geothermal areas include one or more Critically Endangered geothermal ecosystems.

The level of significance of all sites found to be significant when assessed against the BOPRC Criteria (Set 7) was determined using the criteria above. The results of this are summarised in Table 4 and presented in Appendix 2. Thirty-one sites and part of one site (Papakiore) were found to be of National significance, 16 sites were found to be of Regional significance, seven sites and part of one site (Papakiore) were found to be of Local significance, and 14 sites were found to be Not Significant.

5. EXTENT OF SITES

An updated GIS layer of the extent of geothermal vegetation and habitat sites has been provided to the Regional Council, containing new boundaries for all sites that were updated. Most boundary changes are relatively minor and were a result of better quality aerial photographs and additional information gained from field inspections. Some "new" areas have been mapped based on additional knowledge, but these are not new areas of geothermal vegetation/habitat, they are just areas that have not previously been mapped.

Field inspection of most or all of the sites would be likely to result in boundaries being better defined and additional and more up-to-date information being captured as to the diversity and threats to each site, including information on species composition, weed invasion, pest animal impacts, and other threats. Sites where boundaries, or parts of boundaries, were more difficult to determine based on inspection of aerial

photography, due to shading or boundaries of different vegetation types being difficult to determine, are of higher priority for field survey. This should be determined prior to field survey, after overlaying the current site extents over aerial imagery obtained from 2016-2017 aerial photography. This would contribute to determining which sites are the highest priorities for field assessment. To accurately map the entire geothermal site boundary for most sites will require field inspection of specific parts of the boundaries, particularly where the geothermal vegetation or habitat is contiguous with non-geothermal woody vegetation. In some instances boundaries are gorse infested, or changes in vegetation types are difficult to distinguish on the aerial photographs, and for more accurate site boundaries to be identified it may be necessary to walk the boundary, or the use of a drone to take photographs of specific parts of a boundary may be the most cost effective approach.

For most sites, site inspections would result in minor changes of site boundaries. Some sites have recently been inspected and boundaries would be unlikely to change significantly, or it is very apparent that boundaries are more or less accurate, for example Tikitere Northwest, Wonderland, Mokoia Island, Parimahana, Maketū, Te Weta Bay, Kuirau Park. For several sites, field checks would be beneficial to determine extent of geothermal features or vegetation. For example, further field work is required to determine the full extent of geothermal vegetation and habitats that occur locally alongside or near the Tarawera River between Lake Tarawera and SH33. Also, for Waitangi Soda Springs Wetland, a desktop estimate of extent was made for the purposes of the current study however the extent of geothermal influence in the wetland needs to be determined in the field. An additional geothermal area was added to the Parimahana Extension geothermal site and the Maraeroa site is more extensive than the boundaries shown in the 2010 GIS layer, and requires a field inspection to determine the full extent of the site.

All sites where there is real loss in extent of geothermal vegetation/habitat will require a site visit to identify the state of vegetation loss (i.e. the reason for the loss, such as herbicide spraying, animal grazing, substrate modification, vegetation clearance, earthworks etc), and to identify management actions required, e.g. Wonderland, Old Government Gardens, Tikitere Northwest, and potentially Kuirau Park.

6. CONCLUSION

A process for assessing the ecological significance of geothermal vegetation and habitat was developed, incorporating objective processes where possible to facilitate consistent interpretation of significance criteria. The representativeness of geothermal vegetation and habitats can be assessed at the scale of the Taupo Volcanic Zone by assessing geothermal vegetation composition and structure against standards of natural geothermal vegetation, characteristic geothermal plant species, and their typical geothermal substrates. The assessment process uses a high/moderate/low framework in most cases, but in some cases a ‘meets threshold/does not meet threshold’ framework is more appropriate. A framework for assessing the national,

regional, and local significance of geothermal sites was also developed, and when implemented, showed that 31 sites (and part of a further site[1]) in Bay of Plenty Region were nationally significant[1], 16 were regionally significant, seven sites (and part of a further site[2]) were locally significant, and 14 sites were not significant. An updated site layer was developed incorporating boundary changes to geothermal sites. Field inspection will be needed to more accurately determine geothermal site boundaries.

REFERENCES

Beadel S.M., Bishop C., and Shaw W.B. 1999: Category 1 natural heritage sites in the Rotorua and Opotiki Districts, Bay of Plenty Region. *Wildland Consultants Ltd Contract Report No. 292*. 13 pp.

Cody A. 1994: Inventory of landfrms, cold springs, geothermal fields and geothermal features. *Unpublished report and maps.* Prepared for Department of Conservation, Rotorua.

de Lange P., Rolfe J., Champion P., Courtney S., Heenan P., Barkla J., Cameron E., Norton D., and Hitchmough R. 2013: Conservation status of New Zealand indigenous vascular plants, 2012. *New Zealand Threat Classification Series 3*. Department of Conservation, Wellington. 70 pp.

Holdaway R.J., Wiser S.K., and Williams P.A. 2012: Status assessment of New Zealand's naturally uncommon ecosystems. *Conservation Biology 26*: 619-629.

Kenny J.A. and Hayward B.W. 1996: Inventory and maps of important geological sites and landforms in the Bay of Plenty Region. First edition. *Geological Society of New Zealand Miscellaneous Publication No. 86*. 48 pp.

Merrett M.F. and Clarkson B.R. 1999: Definition, description, and illustrations of geothermally influenced terrestrial and emergent wetland vegetation. *Landcare Research Contract Report LC9900/022*.

Wildland Consultants 2015: Ecological indicators for geothermal vegetation and habitats in the Waikato Region. *Wildland Consultants Ltd Contract Report No. 3504*. Prepared for Waikato Regional Council. 21 pp.

Wildland Consultants 2013: Guidelines for the application of ecological significance criteria for indigenous vegetation and habitats of indigenous fauna in Canterbury Region. *Wildland Consultants Ltd Contract Report No. 2289i*. Prepared for Environment Canterbury.

Wildland Consultants 2013 (draft): Significant Natural Areas in the coastal environment of Bay of Plenty Region. *Wildland Consultants Ltd Contract Report No. 2837*. Prepared for Bay of Plenty Regional Council. 719 pp.

[1] Papakiore 19A.
[2] Papakiore 19B.

Williams P.A., Wiser S., Clarkson B., and Stanley M.C. 2007: New Zealand's historically rare terrestrial ecosystems set in a physical and physiognomic framework. *New Zealand Journal of Ecology 31*: 119-128.

BAY OF PLENTY REGIONAL POLICY STATEMENT APPENDIX F SET 7

Appendix F Set 7	**Geothermal Features**
For the avoidance of doubt the criteria sets that apply will only be triggered by the relevant policies and methods listed under each criteria set heading. The criteria in each of the criteria sets below are not tests or standards which, if any one or more are met, will necessarily result in a conclusion that the place, feature or landscape (as the case may be) is significant or a matter of national importance. Instead, the criteria are factors to be considered and evaluated in order to reach an overall judgement as to the significance of any given feature(s). *NB Set 5 criteria 5.1 to 5.7 do not apply to the assessment of the significance of geothermal features, as Set 7 criteria apply to such assessments.*	
For Geothermal geological features: ***(See Appendix A (Definitions) - Annex A, Table 15 and Table 16, Parts A and B)***	***For geothermal vegetation or habitat of indigenous fauna*** ***(See Appendix A (Definitions) - Annex A, Table 15 and Table 16, Part C)***
Natural science factors	
Representativeness 7.1 The extent to which the natural feature is a good example of a geothermal feature type or group of features in close association, and/or the processes that formed it/them, in the Taupō Volcanic Zone.	*Representativeness* 7.12 The extent to which indigenous vegetation or habitat of indigenous fauna on a geothermal area contributes to the full range of associations of indigenous species representative, typical or characteristic of the natural biodiversity of the geothermal resource of the Taupo Volcanic Zone.
Diversity and pattern 7.2 The extent to which a group of associated features contain a wide variety of geothermal features, reflecting the diversity of geothermal feature types in the Taupō Volcanic Zone or present a distinctive and unusual juxtaposition of features (e.g. along a physical, chemical or hydrological gradient).	*Diversity and pattern* 7.13 The extent to which indigenous vegetation or habitat of indigenous fauna on a geothermal area contains a high diversity of indigenous ecosystem or habitat types, or changes in species composition, reflecting the existence of diverse natural features (for example landforms, soil types or hydrology), or communities along an ecological gradient (e.g. a soil temperature gradient).
Rarity 7.3 The extent to which the feature is unique or rare in the context of the Taupō Volcanic Zone.	*Rarity* 7.14 The extent to which indigenous vegetation or habitat of indigenous fauna on a geothermal area supports an indigenous species or associations of indigenous species threatened or rare nationally or regionally. NB the relative significance would be judged on the number of such species present and their threat status.
Distinctiveness 7.4 The extent to which a feature in a geothermal area is one of the largest remaining examples of its type in the Taupō Volcanic Zone, while exhibiting high thermal output.	*Distinctiveness* 7.15 The extent to which indigenous vegetation or habitat of indigenous fauna on a geothermal area is one of the largest remaining examples of its type within the Taupo Volcanic Zone.
	7.16 The extent to which indigenous vegetation or habitat of indigenous fauna on a geothermal area is significantly reduced in area and is degraded but retains key natural ecosystem functions (for example hydrology).
	Ecological context 7.17 The extent to which indigenous vegetation or habitat of indigenous fauna on a geothermal area contributes to the ecological viability of adjoining significant natural areas and biological communities, by providing or contributing to an important ecological linkage or network, or providing a buffer from adjacent land uses.
	7.18 The extent to which indigenous vegetation or habitat of indigenous fauna on a geothermal area provides habitat for threatened indigenous species at key stages of their life cycle.

Resilience 7.5 The extent to which the feature is resilient to natural changes.	*Viability and sustainability* 7.19 The extent to which indigenous vegetation or habitat of indigenous fauna on a geothermal area is of sufficient size and compact shape and that it has the capacity to maintain its ecological viability over time, to adapt to natural changes and to resist changes initiated by external agents.
	7.20 The extent to which indigenous vegetation or habitat of indigenous fauna on a geothermal area supports intact habitats and healthy functioning ecosystems.
Vulnerability 7.6 The extent to which the feature is vulnerable to fluid extraction.	
Aesthetic values	
Memorability 7.7 The extent to which the geothermal feature(s) is striking or visually spectacular due to its recognisable and memorable qualities.	
Naturalness 7.8 The extent to which the geothermal feature(s) appears largely uncompromised and is an intact natural system, free from human modification, intervention or manipulation.	*Naturalness* 7.21 The extent to which indigenous vegetation or habitat of indigenous fauna on a geothermal area is in a natural state or healthy condition, or is in an original condition.
Transient values 7.9 The extent to which transitory natural changes in the appearance of the geothermal feature contribute to its natural science values or aesthetic appeal.	
Associative values	
Shared and recognised values 7.10 The extent to which it is a geothermal feature that is valued for its historical, recreational, educational or scientific values.	*Shared and recognised values* 7.22 The extent to which the geothermal vegetation or habitat is valued for its historical, recreational, educational or scientific values.
Māori values 7.11 The extent to which a geothermal feature(s) is clearly special or widely valued by Tangata Whenua by reason of traditional values (including consideration of the criteria in Set 4 Māori culture and traditions) and/or contemporary association values.	*Māori values* 7.23 The extent to which geothermal vegetation or habitat is clearly special or widely valued by Tangata Whenua by reason of traditional values (including consideration of the criteria in Set 4 Māori culture and traditions) and/or contemporary association values.

SIGNIFICANCE ASSESSMENT OF EACH SITE AGAINST SET 7 CRITERIA AND LEVEL OF SIGNIFICANCE ASSESSMENT

Table 5: Sites in the Bay of Plenty assessed against Criteria Set 7 and for level of significance.

Table 5a: Sites mapped, described, and assessed in previous surveys.

List of Sites		Significant (Against Set 7) Yes/No	Assessment	Level of Significance	Criteria Met
2	Taheke	Yes	H - 7.12, 7.13, 7.14, 7.15, 7.16, 7.17, 7.19, 7.20, 7.21 M - 7.18	National	N2, N3, N4, N5
3	Ōhinemutu	Yes	H - 7.13, 7.14, 7.16, 7.17, 7.18 M - 7.12, 7.15, 7.20, 7.21 L - 7.19	Regional	R4, R6
4	Kuirau Park	Yes	H - 7.13, 7.14, 7.16 M - 7.12, 7.15, 7.17, 7.19, 7.20, 7.21 L - 7.18, 7.20	Regional	R3, R6
5	Sulphur Point	Yes	H - 7.12, 7.13, 7.15, 7.16, 7.17, 7.18, 7.19, 7.20, 7.21 M - 7.14	National	N4, N5
6	Old Government Gardens	Yes	H - 7.12, 7.13, 7.14, 7.15, 7.16, 7.17, 7.21 M - 7.12, 7.19, 7.20, 7.21 L - 7.18	Regional	R3
7	Ngāpuna	Yes	H - 7.12, 7.13, 7.14, 7.15, 7.16, 7.17, 7.18, 7.19, 7.20, 7.21 M - 7.19, 7.20	National	N3, N4, N5
8	Arawa Park Racecourse	Yes	H - 7.16 M - 7.12, 7.13, 7.14, 7.15, 7.21 L - 7.17, 7.18, 7.19, 7.20	Regional	R5
9	Wonderland	Yes	H - 7.12, 7.14, 7.16, 7.21 M - 7.13 L - 7.15, 7.17, 7.18, 7.19, 7.20	Local	L1
10	Arikikapakapa (Golf Course)	Yes	H - 7.13, 7.14, 7.15, 7.16 M - 7.12, 7.17, 7.19, 7.20, 7.21 L - 7.18	Regional	R4
11	Tangatarua (Old Taupo Road Reserve)	Yes	H - 7.12, 7.13, 7.14, 7.16, 7.20, 7.21 M - 7.15, 7.17, 7.19 L - 7.18	Regional	R3
12	Whakarewarewa	Yes	H - 7.12, 7.13, 7.14, 7.15, 7.16, 7.17, 7.19, 7.20, 7.21 L - 7.18	National	N3, N4, N5, N6, N8
13	Redwood Grove Pool	Yes	H - 7.12, 7.16, 7.21 M - 7.17, 7.19, 7.20 L - 7.13, 7.14, 7.15, 7.18	Regional	R3
14	Hells Gate	Yes	H - 7.12, 7.13, 7.14, 7.15, 7.16, 7.17, 7.19, 7.20, 7.21 L - 7.18	National	N3, N4, N5
15	Tikitere Northwest	Yes	H - 7.12, 7.13, 7.14, 7.15, 7.16, 7.19, 7.21 M - 7.17, 7.20 L - 7.18	National	N3, N5
16	Otutarara Springs	Yes	H - 7.12, 7.16, 7.21 M - 7.13, 7.14, 7.15, 7.17, 7.19, 7.20 L - 7.18	Regional	R3
17	Maraeroa	Yes	H - 7.12, 7.13, 7.14, 7.15, 7.16, 7.20, 7.21 M - 7.17, 7.19 L - 7.18	National	N5
18	Ruahine Springs	Yes	H - 7.12, 7.14, 7.16, 7.19, 7.20. 7.21 M - 7.13, 7.15, 7.17 L - 7.18	National	N3
19	Papakiore Springs 19A	Yes	H - 7.12, 7.14, 7.16, 7.20, 7.21 M - 7.13, 7.15, 7.17, 7.19 L - 7.18	National	N3

List of Sites		Significant (Against Set 7) Yes/No	Assessment	Level of Significance	Criteria Met
	Papakiore Springs 19B	Yes	H - 7.14, 7.16 M - 7.12, 7.13, 7.17, 7.19, 7.20, 7.21 L - 7.15, 7.18	Local	L1
20	Parengarenga Springs	Yes	H - 7.12, 7.13, 7.14, 7.15, 7.16, 7.17, 7.20, 7.21 M - 7.19 L - 7.18	National	N3, N5
21	Manupirua Hot Springs	Yes	H - 7.12, 7.16, 7.17, 7.21 M - 7.13, 7.14, 7.20 L - 7.15, 7.18, 7.19	Local	L1
22	Tikitere Bore	No	H - 7.16 M - 7.21 L - 7.12, 7.13, 7.14, 7.15, 7.17, 7.18, 7.19, 7.20	N/A	N/A
25	Mokoia Island	Yes	H - 7.16 M - 7.12, 7.14, 7.17, 7.21 L - 7.13, 7.15, 7.18, 7.19, 7.20	National	N2
26	Waimangu-Rotomahana	Yes	H - 7.12, 7.13, 7.14, 7.15, 7.16, 7.17, 7.19, 7.20, 7.21 L - 7.18	National	N2, N3, N4, N5, N6, N7, N8
28	Tikorangi Central	No	L - 7.12, 7.13, 7.14, 7.15, 7.16, 7.17, 7.18, 7.19, 7.20, 7.21	N/A	N/A
29	Tikorangi South	Yes	H - 7.12, 7.13, 7.14, 7.15, 7.16, 7.17, 7.19, 7.20, 7.21 L - 7.18	National	N3
30	Tikorangi North	Yes	H - 7.13, 7.14, 7.16 M - 7.12, 7.15, 7.17, 7.19, 7.20, 7.21 L - 7.18	Regional	R3, R6
31	Waitangi Soda Springs Mire	Yes	H - 7.12, 7.14, 7.15, 7.16, 7.17, 7.19, 7.20, 7.21 M - 7.18 L - 7.13	National	N2, N3, N5
34	Waitangi Soda Springs Hot Springs	Yes	H - 7.15, 7.16, 7.17 M - 7.12, 7.13, 7.18, 7.19, 7.20, 7.21 L - 7.14	Regional	R3
41	Te Rātā (Hot Water Beach)	Yes	H - 7.12, 7.13, 7.14, 7.16, 7.17, 7.19, 7.20, 7.21 M - 7.15 L - 7.18	National	N2, N3, N4, N5, N7
42	Tarawera Rift	Yes	H - 7.12, 7.16, 7.19, 7.20, 7.21 M - 7.13, 7.14, 7.17 L - 7.15, 7.18	National	N1, N2, N3, N4
43	Parimahana	Yes	H - 7.12, 7.13, 7.14, 7.15, 7.16, 7.19, 7.20, 7.21 M - 7.17 L - 7.18	National	N3, N5, N6
44	Parimahana Extension	Yes	H - 7.13, 7.14, 7.16 M - 7.12, 7.15, 7.17, 7.19, 7.20, 7.21 L - 7.18	Regional	R2, R3, R4, R6
45	Kawerau Township	Yes	H - 7.12, 7.16 M - 7.13, 7.14, 7.17, 7.19, 7.20, 7.21 L - 7.15, 7.18	Regional	R3
56	Puhipuhi	No	L - 7.12, 7.13, 7.14, 7.16, 7.17, 7.18, 7.19, 7.20, 7.21	N/A	N/A
57	Waiaute Springs	Yes	H - 7.12, 7.16, 7.17, 7.19, 7.20, 7.21 M - 7.14 L - 7.13, 7.15, 7.18	National	N2
62	Te Weta Bay	No	H - 7.16 M - 7.14, 7.20 L - 7.12, 7.13, 7.15, 7.17, 7.18, 7.19, 7.21	N/A	N/A

List of Sites		Significant (Against Set 7) Yes/No	Assessment	Level of Significance	Criteria Met
63	Wharetata Bay	Yes	H - 7.16 M - 7.12, 7.13, 7.14, 7.19, 7.20, 7.21 L - 7.15, 7.17, 7.18	Local	L1
64	Cemetery Reserve	Yes	H - 7.13, 7.14, 7.16 M - 7.12, 7.21 L - 7.15, 7.17, 7.18, 7.19, 7.20	Local	L1
65	Puarenga Park (Soccer Park)	Yes	H - 7.12, 7.13, 7.14, 7.16, 7.21 M - 7.17, 7.19, 7.20 L - 7.15, 7.18	Regional	R3, R6
66	Government Gardens (including Rachel Springs)	Yes	H - 7.12, 7.13, 7.14, 7.16, 7.21 M - 7.15, 7.17, 7.19, 7.20 L - 7.18	Local	L1
67	Pohaturoa	Yes	H - 7.16 M - 7.12, 7.13, 7.14, 7.21 L - 7.15, 7.17, 7.18, 7.19, 7.20	Local	L1
68	Te Rei Bay	Yes	H - 7.14, 7.16 M - 7.12, 7.13, 7.17, 7.20, 7.21 L - 7.15, 7.18, 7.19	Local	L1
70	Waimangu North	Yes	H - 7.12, 7.14, 7.16, 7.17, 7.19, 7.20, 7.21 M - 7.13 L - 7.15, 7.18	National	N2
71	Tarawera River Geothermal Springs	Yes	H - 7.12, 7.16, 7.17, 7.19, 7.20, 7.21 M - 7.14 L - 7.13, 7.15, 7.18	National	N2
55	Pukaahu Springs (Awakeri)	Yes	H - 7.16 M - 7.14, 7.20 L - 7.12, 7.13, 7.15, 7.17, 7.18, 7.19, 7.21	Regional	R5
51	Maketū	Yes	H - 7.12, 7.16, 7.21 M - 7.14, 7.15, 7.17, 7.19, 7.20 L - 7.13, 7.18	National	N3
54	Tukuri	Yes	H - 7.12, 7.16, 7.21 M - 7.13, 7.14, 7.15, 7.19, 7.20 L - 7.17, 7.18	Regional	R2
53	Moutohoroa (Whale Island)	Yes	H - 7.12, 7.13, 7.14, 7.15, 7.16, 7.17, 7.19, 7.20, 7.21 L - 7.18	National	N4, N5, N7, N8

Table 5b: Sites not previously assessed in detail, either through lack of information or lack of surface information.

Site		Significant (Against Set 7) Yes/No	Assessment	Level of Significance	Criteria Met
1	Oira Bay, Tūhua (Mayor Island)	Yes	H - 7.12, 7.16, 7.17, 7.19, 7.20, 7.21 M - 7.14 L - 7.13, 7.15	National	N2
60	Moewai Bay, Tūhua (Mayor Island)	Yes	H - 7.12, 7.16, 7.17, 7.19, 7.20, 7.21 M - 7.14 L - 7.13, 7.15	National	N2
61	Orognatea Bay, Tūhua (Mayor Island)	Yes	H - 7.12, 7.16, 7.17, 7.19, 7.20, 7.21 M - 7.14 L - 7.13, 7.15	National	N2
23	Lake Rotoiti	Yes	H - 7.15, 7.16, 7.17, 7.19, 7.20 M - 7.14 L - 7.13	Regional	R6

Site		Significant (Against Set 7) Yes/No	Assessment	Level of Significance	Criteria Met
24	Waikawa Springs (Lake Rotokawa)	No	L - 7.12, 7.13, 7.14, 7.15, 7.16, 7.17, 7.18, 7.19, 7.20, 7.21	N/A	N/A
27	Tikorangi 1	No	L - 7.12, 7.13, 7.14, 7.15, 7.16, 7.17, 7.18, 7.19, 7.20, 7.21	N/A	N/A
32	Otei Springs	No	L - 7.12, 7.13, 7.14, 7.15, 7.16, 7.17, 7.18, 7.19, 7.20, 7.21	N/A	N/A
35	Rotomā School Wetland	No	L - 7.12, 7.13, 7.14, 7.15, 7.16, 7.17, 7.18, 7.19, 7.20, 7.21	N/A	N/A
40	Mangakotukutuku Springs	No	L - 7.12, 7.13, 7.14, 7.15, 7.16, 7.17, 7.18, 7.19, 7.20, 7.21	N/A	N/A
36	Ōkataina	Yes	H - 7.12, 7.16, 7.17, 7.19, 7.20, 7.21 L - 7.13, 7.14, 7.15	National	N2
37	Humphreys Bay (Lake Tarawera)	Yes	H - 7.12, 7.16, 7.17, 7.19, 7.20, 7.21 L - 7.13, 7.14, 7.15	National	N2
38	Lake Tarawera (Western Shores)	Yes	H - 7.12, 7.16, 7.17, 7.19, 7.20, 7.2 L - 7.13, 7.14, 7.15	National	N2
46	Woodlands Hot Springs	No	L - 7.12, 7.13, 7.14, 7.15, 7.16, 7.17, 7.19, 7.20, 7.21	N/A	N/A
47	Sapphire Hot Springs	No	L - 7.12, 7.13, 7.14, 7.15, 7.16, 7.17, 7.18, 7.19, 7.20, 7.21	N/A	N/A
48	Te Puna Spring	No	L - 7.12, 7.13, 7.14, 7.15, 7.16, 7.17, 7.18, 7.19, 7.20, 7.21	N/A	N/A
49	Mt Maunganui Hot Spring	No	L - 7.12, 7.13, 7.14, 7.15, 7.16, 7.17, 7.18, 7.19, 7.20, 7.21	N/A	N/A
50	Welcome Bay Spring	No	L - 7.12, 7.13, 7.14, 7.15, 7.16, 7.17, 7.18, 7.19, 7.20, 7.21	N/A	N/A
52	White Island (Whakaari)	Yes	H - 7.12, 7.13, 7.14, 7.15, 7.16, 7.19, 7.20, 7.21 L - 7.18	National	N2, N3, N4, N5
72	Rūrima Island	Yes	H - 7.12, 7.16, 7.19, 7.20, 7.21 M - 7.14, 7.17 L - 7.13, 7.15	National	N2
58	Pukehinau Hot Springs	Yes	H - 7.12, 7.16, 7.17, 7.19, 7.20, 7.21 L - 7.13, 7.14, 7.15	National	N2
59	Manaohou Hot Springs	Yes	H - 7.12, 7.16, 7.17, 7.19, 7.20, 7.21 L - 7.13, 7.14, 7.15	National	N2

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