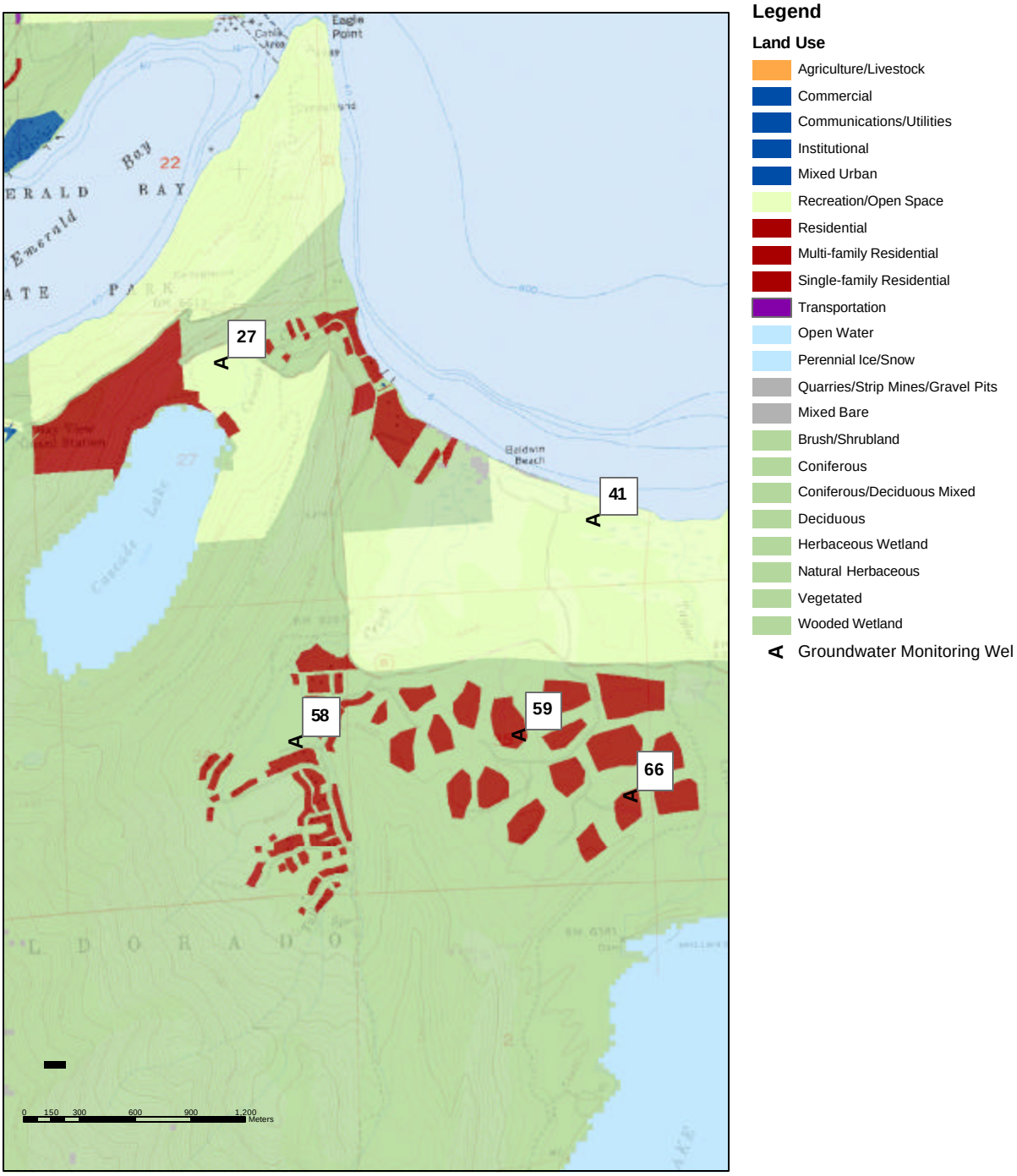
Figure 4-8. Emerald Bay to Taylor Creek Groundwater Wells and Land Use



Notes:

1. Land use coverage provided by Tahoe Research Group
2. Only wells with groundwater elevation and/or analytical data are shown.

4.3.2 Subregion 1 Nutrient Concentrations

The wells and land use in the area are depicted in Figure 4-9. Wells 043, 047, 048 and 051 - 057 have been monitored for all forms of dissolved nitrogen and phosphorus that are of concern as part of this evaluation.

The dissolved ammonia + organic nitrogen concentrations range from 0.01 mg/L to 2.8 mg/L, averaging 0.26 mg/L. The dissolved nitrate concentrations, which include nitrite, range from 0.002 mg/L to 0.108 mg/L with an average of 0.031 mg/L. This results in an average total dissolved nitrogen concentration of 0.289 mg/L. Table 4-4 includes the dissolved nitrogen concentrations for wells in subregion 1.

Orthophosphorus concentrations in subregion 1 range from 0.001 mg/L to 0.051 mg/L, averaging 0.025 mg/L. The range of total dissolved phosphorus is 0.012 mg/L to 0.098 mg/L, averaging 0.035 mg/L. Table 4-4 includes the dissolved phosphorus concentrations for wells in subregion 1.

Wells 043, 047 and 048 are considered the downgradient wells in subregion 1. They are well placed to represent the downgradient conditions for the area. The data shows that the concentrations of nutrients are higher in the downgradient wells versus the upgradient wells. The predominant land use in this area is recreational (Camp Richardson) (Figure 4-9). Large numbers of geese that are typically present in this area could contribute to the increased nutrient concentrations. Because all of the wells in this area are shallow, they likely represent the highest nutrient concentrations in this area.

Table 4-4. South Lake Tahoe Subregion 1 Average Nutrient Concentrations (mg/L)

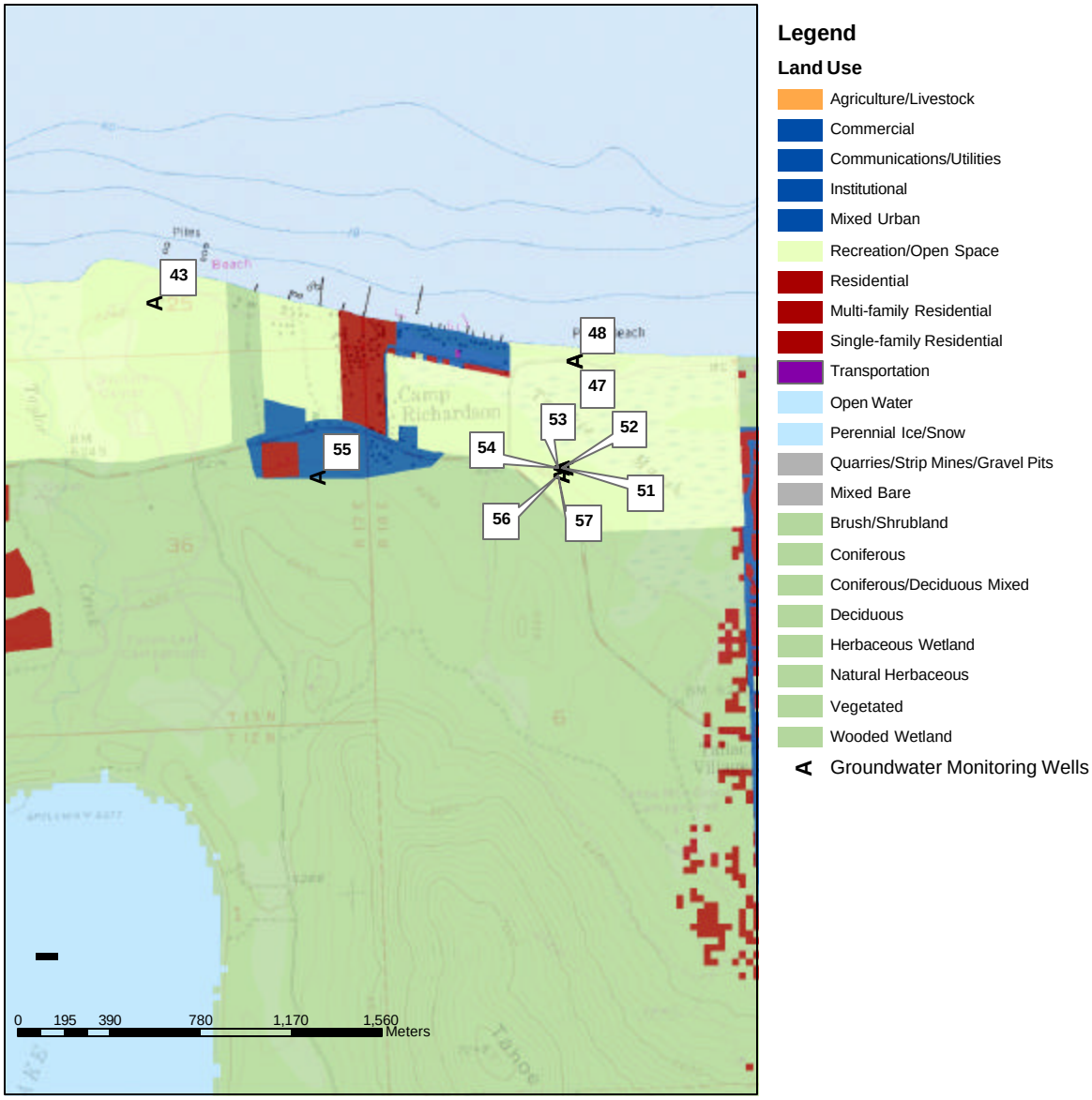
	Well ID				
Constituent	055	056	057	051	052
Ammonia + Organic	na	0.01	0.02	0.07	0.01
Nitrate	0.058	0.023	0.005	0.028	0.02
Total Nitrogen	--	0.033	0.025	0.098	0.03
Orthophosphorus	0.1	0.015	0.003	0.017	0.005
Total Phosphorus	na	0.034	0.018	0.043	0.019
Top of Open Interval (ft bgs)	--	10.25	3.7	8.28	5.15

	Well ID				
Constituent	053	054	047	048	043
Ammonia + Organic	0.05	0.04	1.4218	0.64	0.08
Nitrate	0.007	0.002	0.0678	0.038	0.064
Total Nitrogen	0.057	0.042	1.4896	0.678	0.144
Orthophosphorus	0.011	0.003	0.0337	0.031	0.0325
Total Phosphorus	0.025	0.012	0.0502	0.046	0.0693
Top of Open Interval (ft bgs)	17	3.4	15.45	5	--

Notes:

1. All concentrations reported are dissolved.
2. Data obtained from USGS and STPUD.
3. Top of Open Interval with a – indicates the open interval is unknown. A < indicates less than the total depth of the well.
4. na – not analyzed
5. Total Nitrogen is calculated for those wells with both ammonia + organic and nitrate concentrations.
6. Nitrate concentrations include nitrite.

Figure 4-9. South Lake Tahoe Subregion 1 Groundwater Wells and Land Use



Notes:
1. Land use coverage provided by Tahoe Research Group
2. Only wells with groundwater elevation and/or analytical data are shown.

4.3.3 Subregion 2 Nutrient Concentrations

The wells and land use in the area are depicted in Figure 4-10. Well 050 has been monitored for all forms of the dissolved nutrients of interest to this evaluation. The remaining wells shown in Table 4-5 have only been sampled for dissolved nitrate and total dissolved phosphorus. Wells 076, 081 and 083 have only been sampled to monitor drinking water standard compliance which includes only total nitrate and nitrite.

The dissolved ammonia + organic nitrogen concentrations for well 050 range from 0.001 mg/L to 0.2 mg/L, averaging 0.043 mg/L. The dissolved nitrate concentrations for all wells shown in Table 4-5, which include nitrite, range from 0.01 mg/L to 2.36 mg/L with an average of 0.678 mg/L. Well 050 has an average total dissolved nitrogen concentration of 0.418 mg/L. The average total nitrate concentrations found in wells 076, 081 and 083 range from 0.415 mg/L to 1.01 mg/L. Table 4-5 includes the dissolved nitrogen concentrations for wells 050, and 084 - 087.

Orthophosphorus concentrations for well 050 range from 0.015 mg/L to 0.02 mg/L, averaging 0.018 mg/L. The range of total dissolved phosphorus for all wells shown in Table 4-5 is 0.01 mg/L to 0.78 mg/L, averaging 0.039 mg/L. No phosphorus concentrations have been measured in the other wells in the area. Table 4-5 includes the dissolved phosphorus concentrations for wells 050, and 084 - 087.

The distribution of wells in the area is not suited to characterize the area (Figure 4-10). The downgradient well, 050, would not detect nutrients migrating from the residential neighborhoods to the southwest. There is a noticeable difference in nitrogen concentrations between the deep wells and those in the upper aquifer. The phosphorus concentrations do not vary much downgradient or from upper to lower aquifer. The distribution of nitrogen concentrations in this area seems to be related to nearby sources, and an assessment of cumulative sources is not possible as there are no wells suited to make this assessment. The upgradient cluster of wells located within a residential land use only (wells 084 – 087) does not seem to have a defined trend in nitrate concentrations in the downgradient direction.

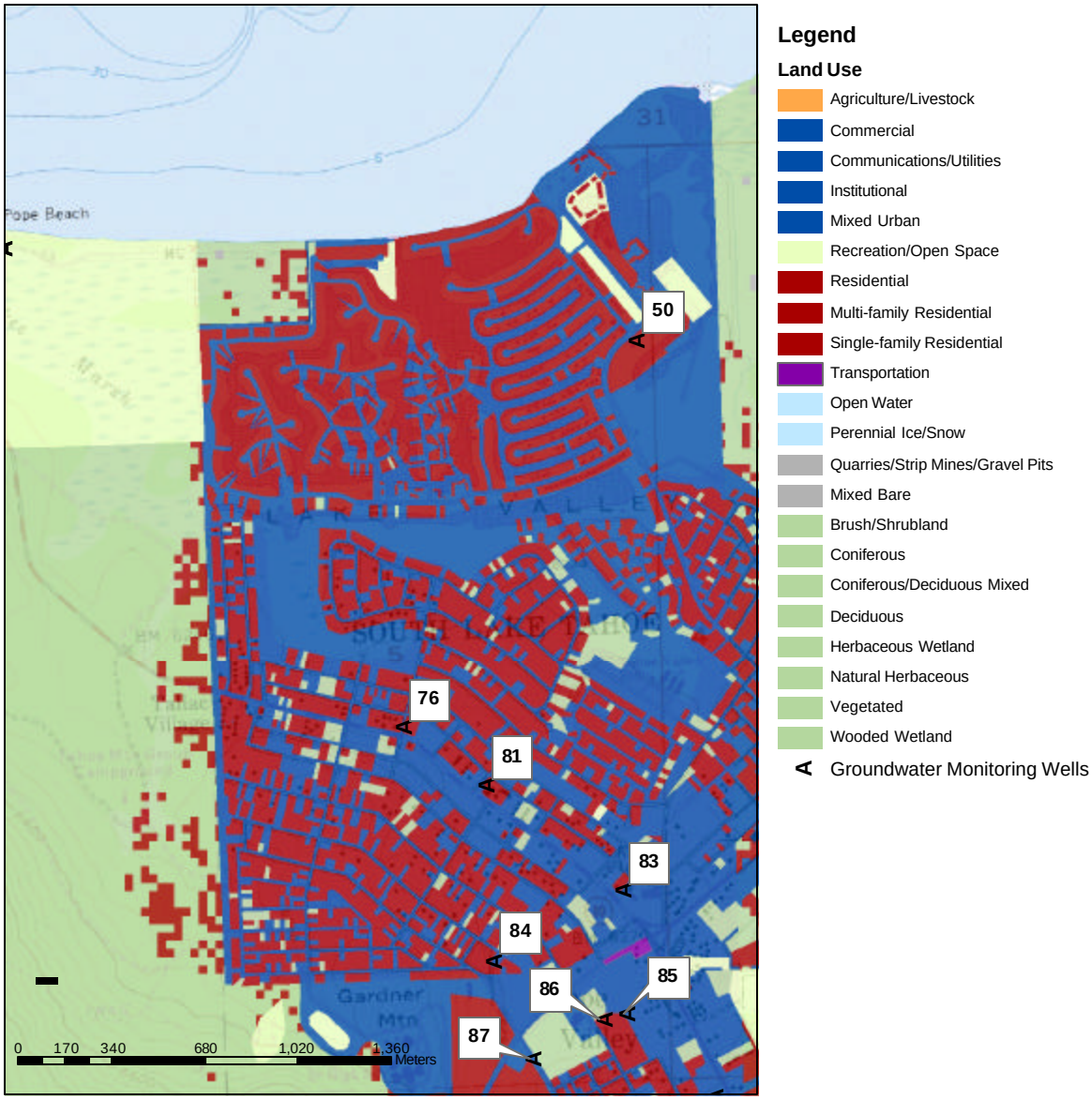
Table 4-5. South Lake Tahoe Subregion 2 Average Nutrient Concentration (mg/L)

	Well ID				
Constituent	084	087	085	086	050
Ammonia + Organic	na	na	na	na	0.043
Nitrate	0.719	1.017	0.029	1.252	0.375
Total Nitrogen	--	--	--	--	0.418
Orthophosphorus	na	na	na	na	0.018
Total Phosphorus	0.027	0.077	0.024	0.037	0.029
Top of Open Interval (ft bgs)	40	65	190	87	<341

Notes:

1. All concentrations reported are dissolved.
2. Data obtained from USGS, and STPUD.
3. Top of Open Interval with a – indicates the open interval is unknown. A < indicates less than the total depth of the well.
4. na – not analyzed
5. Total Nitrogen is calculated for those wells with both ammonia + organic and nitrate concentrations.
6. Nitrate concentrations include nitrite.

Figure 4-10. South Lake Tahoe Subregion 2 Groundwater Wells and Land Use



Notes:
1. Land use coverage provided by Tahoe Research Group
2. Only wells with groundwater elevation and/or analytical data are shown.

4.3.4 Subregion 3 Nutrient Concentrations

The wells and land use in the area are depicted in Figure 4-11. Wells 045 and 049 have been monitored for all forms of the dissolved nutrients of interest to this evaluation. The remaining wells shown in Table 4-6 have only been sampled for dissolved nitrate and total dissolved phosphorus. Wells 034 and 044 have only been sampled to monitor drinking water standard compliance which includes only total nitrate and nitrite.

The dissolved ammonia + organic nitrogen concentrations for wells 045 and 049 range from 0.01 mg/L to 0.2 mg/L, averaging 0.124 mg/L. The dissolved nitrate concentrations for all wells shown in Table 4-6, which include nitrite, range from 0.01 mg/L to 1.31 mg/L with an average of 0.346 mg/L. Wells 045 and 049 have an average total dissolved nitrogen concentration of 0.396 mg/L. The average total nitrate concentrations found in wells 034 and 044 are 1.276 mg/L and 3.614 mg/L, respectively. Table 4-6 includes the dissolved nitrogen concentrations for wells 039, 042, 045 and 049.

Orthophosphorus concentrations for wells 049 and 045 range from 0.01 mg/L to 0.04 mg/L, averaging 0.021 mg/L. The range of total dissolved phosphorus for all wells shown in Table 4-6 is 0.012 mg/L to 0.7 mg/L, averaging 0.033 mg/L. No phosphorus concentrations have been measured in the other wells in the area. Table 4-6 includes the dissolved phosphorus concentrations for wells 039, 042, 045 and 049.

The high total nitrate concentrations found in well 044 could be due to groundwater migrating towards the pumping wells from the vicinity of the golf course and residential neighborhood. Unlike the nutrient concentrations found in subregion 2, the higher nitrogen concentrations are found in the deeper aquifer in this region. Phosphorus concentrations do not vary much with depth. This may be due to the fact that wells 042 and 039 are municipal supply wells used by STPUD. Wells 042 and 039 are STPUD's two primary wells municipal supply for the area. As shown by the groundwater flow model, the pumping forms a significant cone of depression (Fenske 2003). These wells may be drawing the groundwater, along with the nutrients, towards the wells.