Nevada Division of Environmental Protection Screening/Action Level for Arsenic in Surface Soil in the Carson River Basin

1.0 Introduction

This paper discusses the development of a generic screening/action level for background concentrations of arsenic in surface soils within the Carson River basin. The Nevada Division of Environmental Protection (NDEP), Bureau of Corrective Action (BCA) gathered data from 397 native soil samples collected from a depth of 0" – 12" from random sampling locations throughout the Carson River basin in Nevada (Tidball, et al, 1991). These data were statistically evaluated to develop a generic screening/action level of 32 milligrams/kilogram (mg/kg) for arsenic in surface soil within the Carson River basin. NDEP has implemented this approach because arsenic occurs naturally in many of Nevada's soils at levels that exceed generic risk-based concentrations. Details of NDEP's analysis used to develop this screening/action level for arsenic are described in the following sections of this paper.

2.0 Data Summary and Screening/Action Level Calculation

NDEP statistically evaluated arsenic data from 397 soil samples collected to determine the regional distribution of elements in the alluvium of the Carson River basin. These soil samples were collected as part of a study by the National Water Quality Assessment Program (NAWQA) to determine both the character of water quality and the factors that affect that quality (Tidball, et al, 1991). The Carson River Basin was subdivided into a grid of cells, 5 km on a side, and one or more random sampling locations were selected within each cell (Figure 1). Results from a statistical analysis of these data indicate that the samples are representative of the range of native arsenic concentrations in most areas of the Carson River basin. The range of arsenic concentrations extends from a minimum of 1 mg/kg to a maximum of 73 mg/kg (Table 1), with an average (arithmetic mean) of 13.1 mg/kg and a 95^{th} percentile of 32 mg/kg.

The arsenic data were plotted on normal probability plots, using both raw and log-transformed values (Figure 2). Normal probability plots are graphs of measurements, ordered from lowest to highest and plotted against a standard normal distribution function. The vertical axis is scaled in units of concentration, and the horizontal axis is scaled in units of the normal distribution function (normal quantile). Data that are normally distributed will fall along the diagonal line in the plots of concentration versus the expected normal quantile; data that are lognormally distributed will show the same relationship when the log-transformed values are plotted on such a graph. Here, the arsenic data show a good fit to a lognormal distribution (see Figure 2). (However, NDEP notes that the large sample size [n = 397] of this data set allows the data to be treated as a normally distributed sample population, according to the Central Limit Theorem [see USEPA, 2006]).

This graphical analysis of the arsenic data shows a nearly continuous distribution with perhaps a slight inflection at approximately 40 mg/kg (see Figure 2). This distribution, along with the lack of extreme values, suggests that the data represent a single background population (or perhaps two slightly different background populations that reflect differences in the source and sink area of the basin). The data plotted on a map show that higher concentrations of arsenic are generally found in the lower reaches of the drainage basin, in the area of the Carson Sink (see Figure 1). This spatial distribution is consistent with the geochemical behavior of arsenic in an alkaline oxidizing

environment, where dissolved arsenic migrates readily as an oxyanion before accumulating in the sediments and soils of a closed basin (Hem, 1992).

NDEP's evaluation of the arsenic data indicates that the 397 samples are representative of the range of variability within a single background population. Therefore, NDEP has determined that the 95th percentile of 32 mg/kg represents an appropriate and conservative generic screening/action level for arsenic in surface soils within the Carson River drainage basin. The 95th percentile of 32 mg/kg represents native soil concentrations that can reasonably be expected for most areas of the Carson River basin.

3.0 Sample Preparation

Soil samples were air dried at ambient temperature and aggregates were gently crushed to pass a 2 mm stainless steel screen. The material less than 2 mm was thoroughly mixed and split in a Jones splitter. A subsample was then ground to less than 100 mesh using a vertical grinder equipped with ceramic plates (Tidball, et al, 1991).

Twenty five percent of the analysis-of-variance soil samples represent analytical duplicates. In addition, four internal reference standards were randomized within every group of 40 analyses. All samples, replicates, and standards were randomized and analyzed in that order. This has the effect of transforming any systematic laboratory error into a random error (Tidball, et al, 1991).

4.0 Analytical Technique

Arsenic levels were determined by utilizing the continuous-flow hydride generation atomic absorption spectroscopy method. A 0.25 g sample was digested with HNO_3, $HClO_4$, H_2SO_4, and HF acids. After digestion, the sample was diluted to 54 ml with 10 percent HCl acid and allowed to sit overnight to ensure the conversion of Se-VI to Se-IV. An aliquot of the sample was reacted with sodium borohydride in a continuous flow system to generate the appropriate gaseous hydride compound. The hydride gas was separated from the aqueous phase using a specially designed phase separator and the gas was swept into a quartz atomization cell positioned in the light path of the atomic absorption spectrometer. Arsenic was quantified using a series of external standards and the appropriate linear regression procedure. The lower limits of determination for Arsenic was 0.1 (mg/kg). The relative standard deviation for these determinations was approximately 10 percent (Tidball, et al 1991).

5.0 Standard Screening Level Approach

Typically, NDEP employs generic screening levels, such as the United States Environmental Protection Agency (EPA) Region 9 Regional Screening Levels (RSLs) (EPA9, 2010) for residential soil, when making an initial determination regarding potential soil contamination at a site. Soil concentrations that exceed the RSLs require further analysis to determine whether the facility poses an unacceptable risk to human health or the environment. EPA Region 9 calculates these RSLs conservatively without consideration of site-specific factors and bases the RSLs for carcinogens, like arsenic, on a 1×10^{-6} excess individual cancer risk. The EPA Region 9 RSL for arsenic in residential soil is 0.39 mg/kg (EPA9, 2010). Arsenic has been shown to have both carcinogenic and non-carcinogenic effects (ATSDR, 2000; IRIS, 2005).

The data NDEP utilized indicates that arsenic concentrations in native Carson River basin soils can range from 1 mg/kg to 73 mg/kg. Generally, cleanup levels are not set at concentrations below naturally occurring levels. Since the range of arsenic concentrations in native Carson River basin

soils exceeds the residential RSL, NDEP does not consider the EPA9 RSL an appropriate screening level for arsenic in Carson River basin soils.

6.0 Screening/Action Level Applicability

With this paper NDEP intends to provide a reasonable screening/action level for unrestricted exposure to arsenic in surface soil. NDEP intends that this screening/action level be used generally to determine whether remediation of arsenic is necessary at sites located within the Carson River basin unless site-specific information indicates that this screening/action level is not appropriate. NDEP considers arsenic unique in that it is generally present in Nevada soils at concentrations above the Region 9 RSL and NDEP does not intend to implement the same approach for other contaminants.

It is important to note that NDEP considers the top two feet of soil to be surface soil. The EPA Risk Assessment Guidance for Superfund (RAGS) Volume I Human Health Evaluation Manual (Part A) states, "Assessment of surface exposures will be more certain if samples are collected from the shallowest depth that can be practically obtained, rather than, for example, zero to two feet" (EPA, 1989). However, the arsenic surface soil screening/action levels apply to the top two feet of soil to account for changes in the soil column resulting from activities like gardening, children and pets digging, resodding, bioturbation (worms, ants, moles, etc. disturbing the soil) and repairing roads or driveways. Therefore, NDEP recommends that investigators collect samples from various depths no more than 1 foot in thickness throughout the top two feet of soil in order to make decisions regarding remediation.

7.0 Site-Specific Screening/action Levels

NDEP's generic screening/action level may not be appropriate for all sites. Site-specific background concentrations may exceed the generic screening/action level of 32 mg/kg. If this is likely, NDEP encourages investigators to collect a statistically significant number of background samples to establish a valid site-specific background concentration. Because soils are generally heterogeneous, NDEP typically requires 20 or more soil samples for statistical analyses. Because arsenic occurs in different forms in the soil, it may be appropriate to calculate site-specific risk-based concentrations based on the type of arsenic found at the site. NDEP may require site-specific speciation or bioavailability analysis or both at sites where this approach is proposed. If land use restrictions are appropriate for an industrial or recreational facility, NDEP may consider site-specific risk-based concentrations based on limited exposure appropriate.

8.0 Conclusion

In conclusion, NDEP has developed a generic screening/action level of 32 mg/kg for arsenic based on the 95th percentile of the normal probability distribution of 397 sample locations randomly distributed throughout the Carson River basin.

This screening level can be used in making an initial determination regarding potential arsenic contamination in soil at a site located in the Carson River basin. If adequate sampling indicates that site-specific background concentrations exceed this level, site-specific cleanup levels may be appropriate. In addition, if the technical practicability or the costs of cleaning up a facility to 32 mg/kg or both warrant developing a site-specific cleanup level based on speciation or site-specific bioavailability studies NDEP may consider alternate screening/action levels on a site-specific basis.

9.0 References

ATSDR, 2000. Toxicological Profile for Arsenic. U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. September.

EPA, 1989. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part A) Interim Final. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response. December. EPA/540/1-89/002.

EPA, 2006. Data Quality Assessment: Statistical Methods for Practitioners, QA/G-9S. EPA/240/B-06/003. February.

EPA9, 2010. Regional Screening Levels for Chemical Contaminants at Superfund Sites. May 2010.

Hem, J.D., 1992. Study and Interpretation of the Chemical Characteristics of Natural Water. U.S. Geological Survey Water-Supply Paper 2254.

IRIS, 2005. Integrated Risk Information System. U.S. Environmental Protection Agency.

MDEQ 2005. Montana Department of Environmental Quality, Remediation Division, Action Level for Arsenic in Surface Soil. April 2005.

Tidball et al, 1991. Analytical Data for Soil and Well Core Samples from the Carson River Basin, Lyon and Churchill Counties, Nevada. 1991. R.R. Tidball, P.H. Briggs, K.C. Stewart, R.B. Vaughn, and E.P. Welsch. USGS open file report 91-584A.

FIGURE 1 – SPATIAL LOCATION OF INDIVIDUAL ARSENIC SAMPLES

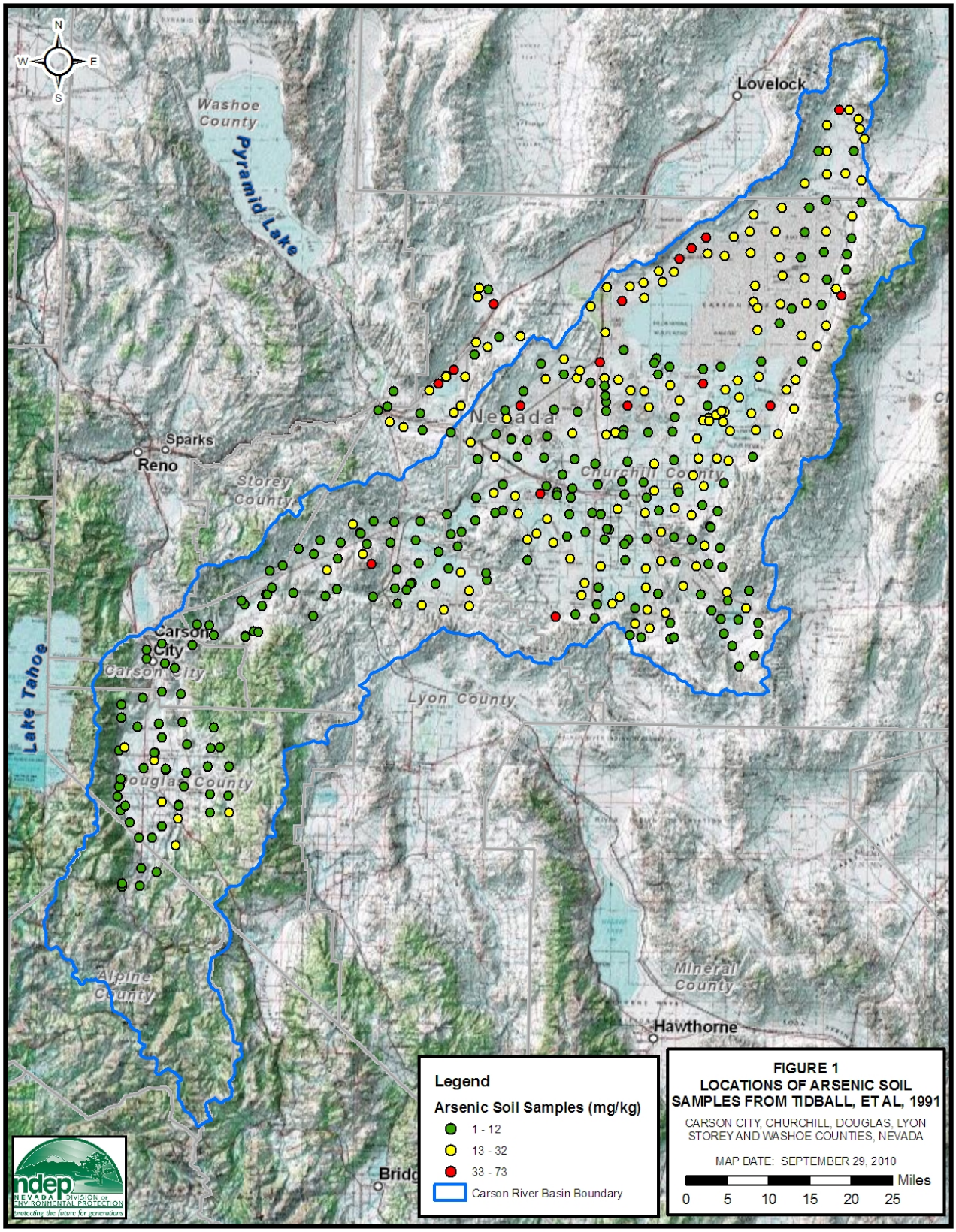
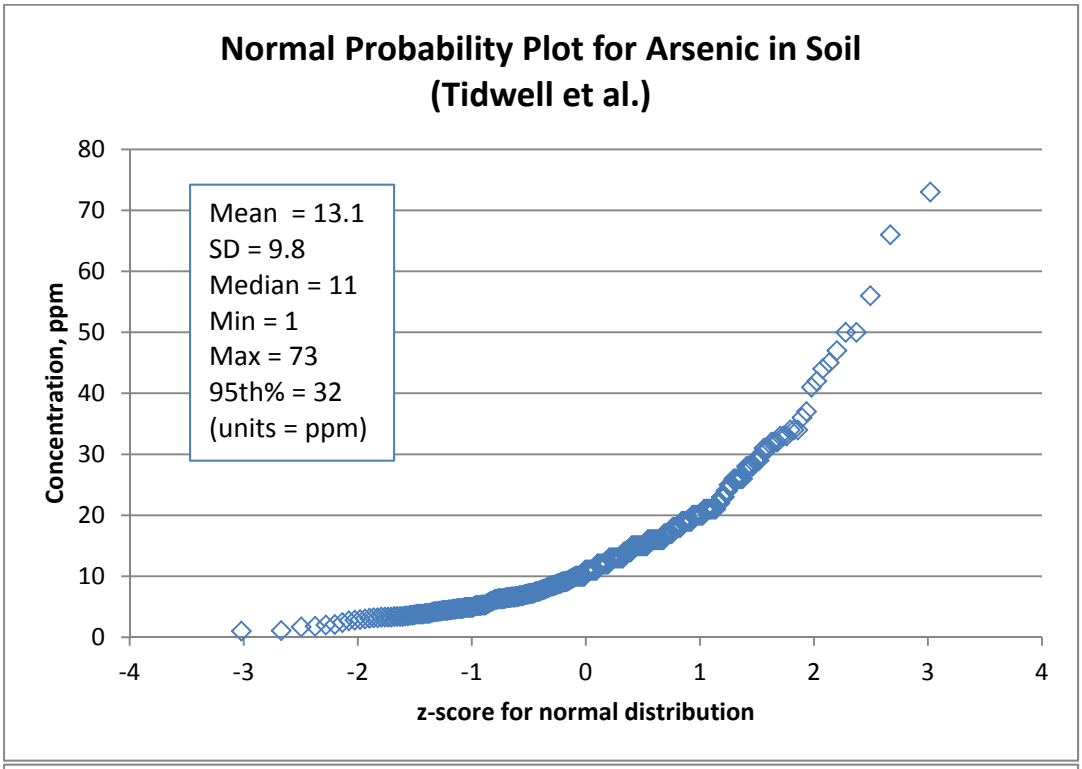


FIGURE 2 – PROBABLITY PLOTS OF ARSENIC DATA



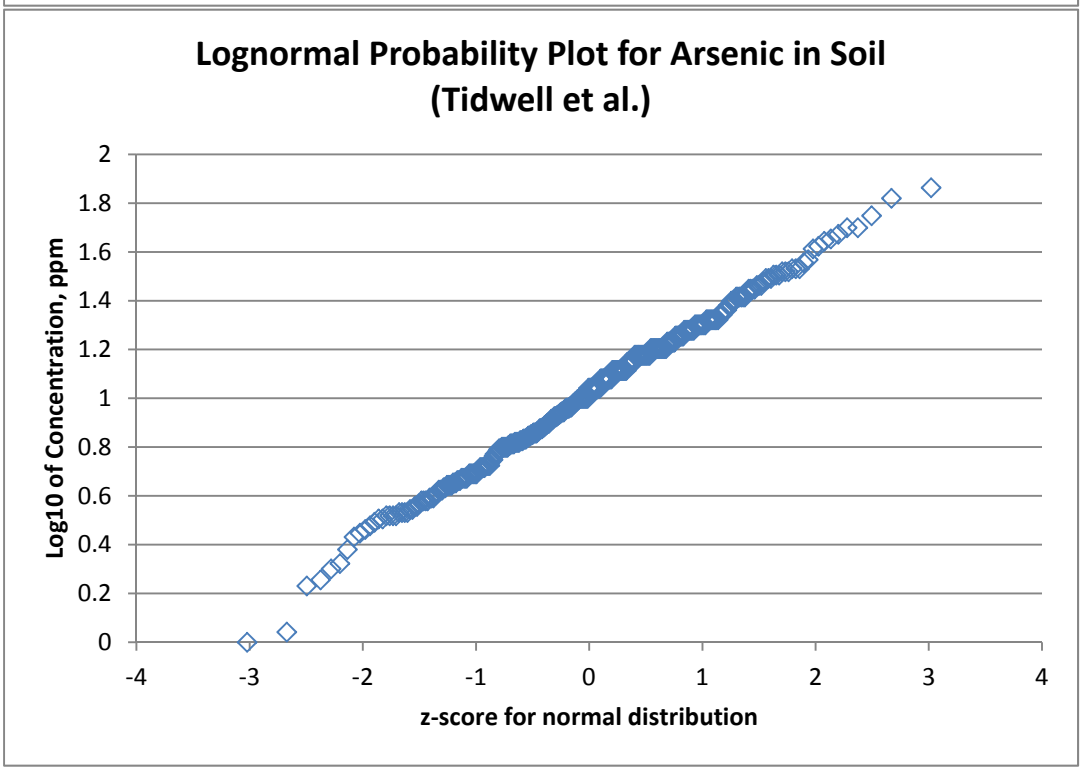


TABLE 1 – INDIVIDUAL ARSENIC SAMPLE RESULTS

SAMPLE ID	SECOND ID	LATITUDE	LONGITUDE	ARSENIC LEVEL (mg/kg)
1111	D286640	39.61555	-118.6036	16
1121	D286662	39.61555	-118.6036	6.3
1211	D286594	39.64444	-118.5931	21
2111	D286564	39.30056	-118.8072	15
2121	D286555	39.30056	-118.8067	19
2211	D286531	39.32167	-118.8008	13
3111	D286674	39.40667	-118.9108	10
3121	D286652	39.40667	-118.9114	20
3211	D286577	39.39111	-118.8725	19
4111	D286298	39.67916	-118.7333	32
4121	D286649	39.67916	-118.7333	31
4211	D286644	39.66083	-118.7044	16
5111	D286312	39.57167	-118.9728	6.4
5121	D286432	39.57111	-118.9722	5.3
5211	D286479	39.56972	-118.9364	10
6111	D286408	39.58528	-118.7364	3.6
6121	D286359	39.58639	-118.7372	28
6211	D286720	39.59083	-118.7189	9.1
7111	D286613	39.42445	-118.5189	19
7121	D286321	39.42389	-118.5181	8.4
7211	D286332	39.40167	-118.5608	6.3
8111	D286488	39.45083	-118.6369	3.7
8121	D286573	39.45083	-118.6367	8.7
8211	D286429	39.44639	-118.6664	26
9111	D286660	39.245	-118.6514	33
9121	D286736	39.245	-118.6514	25
9211	D286402	39.22778	-118.6703	3.2
10111	D286443	38.91555	-119.7003	8.8
10121	D286557	38.915	-119.7006	8.8
10211	D286665	38.94833	-119.6894	5.3
11111	D286606	38.97639	-119.7319	15
11121	D286353	38.9775	-119.7314	12
11211	D286735	38.99139	-119.7592	13
12111	D286466	38.94611	-119.8336	1.7
12121	D286511	38.945	-119.8353	3.5
12211	D286498	38.9275	-119.8389	1.8
13111	D286287	39.00555	-119.7564	7.5

13121	**D286431**	**39.00528**	**-119.7583**	**7.5**
13211	**D286275**	**39.03305**	**-119.7433**	**4.7**
14111	**D286352**	**39.215**	**-119.5628**	**6.7**
14121	**D286697**	**39.21389**	**-119.5628**	**5.8**
14211	**D286602**	**39.22333**	**-119.5428**	**3.9**
15111	**D286356**	**39.28806**	**-119.5189**	**11**
15121	**D286454**	**39.28806**	**-119.5147**	**10**
15211	**D286505**	**39.30111**	**-119.5047**	**3.3**
16111	**D286585**	**39.36195**	**-119.4119**	**7.3**
16121	**D286618**	**39.36083**	**-119.4119**	**9.3**
16211	**D286603**	**39.33417**	**-119.3822**	**17**
17111	**D286528**	**39.40083**	**-119.3092**	**6.9**
17121	**D286525**	**39.39944**	**-119.3089**	**5.3**
17211	**D286685**	**39.38167**	**-119.2939**	**12**
18111	**D286707**	**39.31472**	**-119.1894**	**7.8**
18121	**D286686**	**39.31306**	**-119.1939**	**6.6**
18211	**D286295**	**39.30222**	**-119.2019**	**11**
19111	**D286572**	**39.67889**	**-119.1236**	**28**
19121	**D286611**	**39.67805**	**-119.1231**	**32**
19211	**D286278**	**39.66583**	**-119.1408**	**50**
20111	**D286519**	**39.62333**	**-119.2558**	**7**
20121	**D286387**	**39.62333**	**-119.2544**	**6.3**
20211	**D286703**	**39.59583**	**-119.2494**	**13**
21111	**D286358**	**39.22611**	**-118.6042**	**3.6**
21121	**D286430**	**39.22611**	**-118.6042**	**4.6**
21211	**D286384**	**39.23**	**-118.5967**	**3.4**
22111	**D286634**	**39.81972**	**-118.4292**	**16**
22121	**D286728**	**39.82**	**-118.4289**	**15**
22211	**D286514**	**39.80972**	**-118.4206**	**16**
25542900	**D286484**	**38.76889**	**-119.8219**	**1**
25542950	**D286503**	**38.77472**	**-119.8222**	**2**
25543050	**D286366**	**38.90361**	**-119.8306**	**2.1**
25543150	**D286446**	**38.9575**	**-119.8331**	**7**
25543200	**D286490**	**39.00806**	**-119.8375**	**3.5**
25543250	**D286504**	**39.06583**	**-119.8353**	**4.1**
25543300	**D286710**	**39.08778**	**-119.8361**	**3.4**
26042900	**D286418**	**38.77111**	**-119.7817**	**2.4**
26042950	**D286548**	**38.80278**	**-119.7806**	**3.3**
26043000	**D286563**	**38.85639**	**-119.7875**	**5.2**
26043050	**D286489**	**38.88222**	**-119.8083**	**7.6**
26043100	**D286372**	**38.91139**	**-119.8197**	**4.2**

26043150	**D286444**	**38.97833**	**-119.7822**	**9.1**
26043200	**D286389**	**39.01333**	**-119.8261**	**13**
26043250	**D286283**	**39.04972**	**-119.7978**	**3.4**
26043300	**D286664**	**39.10056**	**-119.7892**	**1.1**
26043350	**D286617**	**39.16972**	**-119.7825**	**5.9**
26043400	**D286276**	**39.185**	**-119.7836**	**3**
26542950	**D286666**	**38.79694**	**-119.7453**	**4**
26543000	**D286675**	**38.85695**	**-119.7578**	**4.4**
26543050	**D286360**	**38.8775**	**-119.7375**	**2.7**
26543100	**D286310**	**38.92056**	**-119.7381**	**16**
26543250	**D286307**	**39.05667**	**-119.7508**	**8**
26543300	**D286616**	**39.11333**	**-119.7458**	**3.3**
26543350	**D286689**	**39.16222**	**-119.7411**	**7.7**
26543400	**D286347**	**39.1975**	**-119.7494**	**3.1**
27043000	**D286343**	**38.84472**	**-119.7042**	**14**
27043050	**D286592**	**38.89139**	**-119.7022**	**14**
27043150	**D286455**	**38.9725**	**-119.6858**	**6.7**
27043200	**D286622**	**39.02139**	**-119.6853**	**6.8**
27043250	**D286658**	**39.06028**	**-119.6972**	**10**
27043300	**D286393**	**39.10944**	**-119.7025**	**2.8**
27043350	**D286314**	**39.15472**	**-119.7186**	**7.2**
27043400	**D286344**	**39.19639**	**-119.6797**	**5.2**
27043450	**D286702**	**39.23306**	**-119.6722**	**5.6**
27543050	**D286442**	**38.90333**	**-119.63**	**8.4**
27543100	**D286369**	**38.93611**	**-119.6306**	**6.1**
27543150	**D286445**	**38.98444**	**-119.6386**	**4.3**
27543200	**D286598**	**39.01694**	**-119.6322**	**6.5**
27543201	**D286364**	**39.01805**	**-119.6119**	**8.2**
27543250	**D286508**	**39.0525**	**-119.6275**	**7.2**
27543400	**D286468**	**39.21472**	**-119.6336**	**6.2**
27543450	**D286588**	**39.23139**	**-119.6433**	**11**
28043050	**D286440**	**38.90472**	**-119.5872**	**26**
28043100	**D286706**	**38.93417**	**-119.5894**	**4.7**
28043150	**D286515**	**38.985**	**-119.5897**	**8.4**
28043450	**D286684**	**39.26944**	**-119.5664**	**6.5**
28043451	**D286636**	**39.25333**	**-119.4094**	**8.7**
28043500	**D286527**	**39.27611**	**-119.5731**	**5.6**
28543400	**D286737**	**39.22222**	**-119.5331**	**2.9**
28543450	**D286361**	**39.26805**	**-119.5261**	**3.3**
28543550	**D286726**	**39.32944**	**-119.5111**	**5.2**
29043500	**D286716**	**39.29278**	**-119.4564**	**11**

29043550	**D286318**	**39.33917**	**-119.4817**	**7.9**
29043600	**D286377**	**39.37**	**-119.4478**	**11**
29543500	**D286713**	**39.28778**	**-119.3844**	**9.1**
29543600	**D286668**	**39.38639**	**-119.3986**	**10**
30043500	**D286537**	**39.30111**	**-119.3583**	**12**
30043550	**D286329**	**39.35389**	**-119.3581**	**4.9**
30043600	**D286670**	**39.38306**	**-119.3525**	**5.3**
30043650	**D286532**	**39.41555**	**-119.3264**	**14**
30543500	**D286740**	**39.28972**	**-119.2767**	**12**
30543550	**D286428**	**39.36361**	**-119.3022**	**16**
30543551	**D286306**	**39.34722**	**-119.2828**	**73**
30543650	**D286741**	**39.42194**	**-119.2794**	**7.4**
30543850	**D286448**	**39.61583**	**-119.275**	**7.2**
31043450	**D286492**	**39.27806**	**-119.2219**	**3.8**
31043500	**D286724**	**39.30472**	**-119.2267**	**4.4**
31043550	**D286333**	**39.33805**	**-119.2247**	**12**
31043600	**D286692**	**39.38472**	**-119.2406**	**12**
31043650	**D286463**	**39.42167**	**-119.2336**	**7.1**
31043800	**D286714**	**39.5875**	**-119.2183**	**13**
31043900	**D286456**	**39.65055**	**-119.2425**	**4.7**
31543450	**D286317**	**39.27583**	**-119.1664**	**28**
31543550	**D286621**	**39.35**	**-119.175**	**4.3**
31543600	**D286690**	**39.39028**	**-119.1831**	**8.3**
31543650	**D286587**	**39.42361**	**-119.1739**	**9.2**
31543800	**D286687**	**39.5825**	**-119.1747**	**8.8**
31543850	**D286438**	**39.61195**	**-119.18**	**6.5**
31543900	**D286400**	**39.6525**	**-119.1606**	**21**
32043450	**D286513**	**39.26889**	**-119.1156**	**21**
32043500	**D286415**	**39.31445**	**-119.1364**	**4.9**
32043550	**D286556**	**39.37083**	**-119.1319**	**4.9**
32043551	**D286698**	**39.34195**	**-119.1086**	**3.8**
32043600	**D286614**	**39.40194**	**-119.1044**	**8.2**
32043650	**D286420**	**39.43667**	**-119.1147**	**6.3**
32043800	**D286677**	**39.57972**	**-119.1092**	**11**
32043850	**D286470**	**39.615**	**-119.1036**	**20**
32043950	**D286679**	**39.69**	**-119.1069**	**33**
32543450	**D286471**	**39.27667**	**-119.0592**	**28**
32543500	**D286654**	**39.30444**	**-119.0597**	**18**
32543550	**D286522**	**39.33611**	**-119.0803**	**13**
32543600	**D286565**	**39.40722**	**-119.0806**	**6.6**
32543601	**D286733**	**39.38111**	**-119.0886**	**6.3**

32543650	**D286597**	**39.4275**	**-119.0508**	**11**
32543701	**D286424**	**39.46778**	**-119.0497**	**7.1**
32543750	**D286571**	**39.53444**	**-119.0486**	**12**
32543800	**D286520**	**39.56417**	**-119.0639**	**15**
32543850	**D286309**	**39.62722**	**-119.0894**	**26**
32543900	**D286401**	**39.67805**	**-119.0808**	**19**
32543950	**D286709**	**39.7175**	**-119.0597**	**12**
32544000	**D286635**	**39.73889**	**-119.0572**	**20**
32544050	**D286586**	**39.81778**	**-119.0564**	**13**
32544100	**D286517**	**39.83417**	**-119.0542**	**15**
33043500	**D286494**	**39.32306**	**-119.0206**	**6.3**
33043550	**D286378**	**39.33472**	**-119.0228**	**7.1**
33043650	**D286669**	**39.44611**	**-118.9883**	**10**
33043651	**D286327**	**39.44139**	**-119.0058**	**11**
33043700	**D286342**	**39.49111**	**-118.9892**	**9.5**
33043701	**D286397**	**39.47667**	**-119.0097**	**15**
33043750	**D286553**	**39.53972**	**-119.0083**	**23**
33043800	**D286625**	**39.58**	**-119.0075**	**12**
33043850	**D286567**	**39.60695**	**-118.9847**	**15**
33043851	**D286620**	**39.62111**	**-118.9875**	**9.1**
33043950	**D286650**	**39.73195**	**-119.0306**	**20**
33044000	**D286480**	**39.74944**	**-119.0056**	**12**
33044050	**D286390**	**39.80722**	**-119.0192**	**66**
33044100	**D286695**	**39.83194**	**-119.0322**	**10**
33543550	**D286413**	**39.36028**	**-118.9306**	**6.7**
33543600	**D286558**	**39.39611**	**-118.9311**	**17**
33543650	**D286705**	**39.44139**	**-118.9533**	**17**
33543700	**D286405**	**39.47222**	**-118.9619**	**17**
33543750	**D286516**	**39.53944**	**-118.9583**	**4.9**
33543850	**D286599**	**39.63028**	**-118.9539**	**41**
33543900	**D286467**	**39.65556**	**-118.9475**	**7.5**
33544000	**D286322**	**39.75111**	**-118.9564**	**14**
34043450	**D286286**	**39.26194**	**-118.865**	**50**
34043650	**D286350**	**39.43333**	**-118.8881**	**17**
34043651	**D286609**	**39.48**	**-118.8658**	**4.6**
34043700	**D286370**	**39.47667**	**-118.9044**	**56**
34043701	**D286570**	**39.49055**	**-118.8917**	**7.9**
34043702	**D286376**	**39.47472**	**-118.8667**	**7.5**
34043750	**D286552**	**39.54**	**-118.8981**	**4.4**
34043800	**D286628**	**39.57722**	**-118.8922**	**4.5**
34043850	**D286363**	**39.62444**	**-118.8769**	**5.9**

34043900	**D286447**	**39.67833**	**-118.8972**	**26**
34043950	**D286610**	**39.70417**	**-118.9094**	**12**
34543450	**D286729**	**39.26694**	**-118.8203**	**7.2**
34543550	**D286379**	**39.36444**	**-118.8339**	**20**
34543600	**D286419**	**39.4025**	**-118.8414**	**3.9**
34543601	**D286433**	**39.41083**	**-118.8011**	**9.7**
34543650	**D286373**	**39.44139**	**-118.8378**	**6.6**
34543700	**D286460**	**39.48778**	**-118.8317**	**6.3**
34543701	**D286473**	**39.47139**	**-118.8361**	**4.5**
34543702	**D286409**	**39.51056**	**-118.8561**	**5.2**
34543750	**D286305**	**39.53806**	**-118.8281**	**6.5**
34543800	**D286590**	**39.58417**	**-118.8347**	**14**
34543850	**D286678**	**39.62167**	**-118.8239**	**10**
34543900	**D286543**	**39.68028**	**-118.8278**	**18**
34543901	**D286596**	**39.68694**	**-118.8561**	**10**
34543950	**D286732**	**39.69361**	**-118.8203**	**15**
34543951	**D286711**	**39.7125**	**-118.8572**	**14**
35043450	**D286738**	**39.26028**	**-118.7758**	**8.2**
35043451	**D286591**	**39.28389**	**-118.7714**	**9.2**
35043500	**D286391**	**39.31389**	**-118.7697**	**12**
35043550	**D286510**	**39.35194**	**-118.7653**	**15**
35043600	**D286676**	**39.39806**	**-118.7581**	**7.9**
35043601	**D286392**	**39.41611**	**-118.7467**	**6.6**
35043602	**D286311**	**39.41778**	**-118.7522**	**6.8**
35043650	**D286354**	**39.44305**	**-118.7667**	**6.6**
35043651	**D286313**	**39.445**	**-118.7858**	**9.2**
35043700	**D286693**	**39.49417**	**-118.7758**	**5.2**
35043750	**D286578**	**39.53083**	**-118.7822**	**10**
35043800	**D286655**	**39.58167**	**-118.7581**	**13**
35043850	**D286457**	**39.62305**	**-118.7597**	**10**
35043851	**D286476**	**39.63917**	**-118.7608**	**4.6**
35043900	**D286637**	**39.67194**	**-118.7956**	**6.8**
35043901	**D286331**	**39.68139**	**-118.7653**	**27**
35043902	**D286725**	**39.6675**	**-118.7636**	**3.2**
35043903	**D286301**	**39.65083**	**-118.7617**	**6.2**
35043950	**D286404**	**39.70917**	**-118.7764**	**36**
35044000	**D286338**	**39.76111**	**-118.765**	**24**
35044050	**D286589**	**39.80695**	**-118.7992**	**29**
35044100	**D286717**	**39.84083**	**-118.7636**	**13**
35543400	**D286672**	**39.2325**	**-118.6964**	**9.8**
35543450	**D286546**	**39.27917**	**-118.6847**	**11**

35543451	**D286340**	**39.25195**	**-118.685**	**29**
35543500	**D286500**	**39.29889**	**-118.7203**	**16**
35543501	**D286328**	**39.28611**	**-118.7375**	**18**
35543550	**D286374**	**39.36361**	**-118.71**	**7.6**
35543600	**D286575**	**39.39944**	**-118.7042**	**6.4**
35543601	**D286673**	**39.39083**	**-118.7125**	**10**
35543650	**D286708**	**39.4525**	**-118.7292**	**30**
35543700	**D286477**	**39.50028**	**-118.7206**	**7.7**
35543701	**D286538**	**39.47833**	**-118.715**	**7.8**
35543750	**D286701**	**39.53639**	**-118.7086**	**4.9**
35543801	**D286320**	**39.58278**	**-118.7197**	**6.5**
35543850	**D286680**	**39.63361**	**-118.7119**	**33**
35543950	**D286541**	**39.73167**	**-118.7233**	**9.9**
35544050	**D286334**	**39.81694**	**-118.7283**	**34**
35544100	**D286459**	**39.84278**	**-118.7122**	**26**
36043450	**D286349**	**39.27722**	**-118.6572**	**26**
36043500	**D286291**	**39.31611**	**-118.6628**	**16**
36043501	**D286288**	**39.305**	**-118.6344**	**9.9**
36043550	**D286723**	**39.34972**	**-118.6622**	**13**
36043551	**D286284**	**39.3625**	**-118.6294**	**23**
36043600	**D286540**	**39.41444**	**-118.6306**	**17**
36043601	**D286434**	**39.40139**	**-118.6628**	**12**
36043700	**D286593**	**39.48555**	**-118.6475**	**15**
36043701	**D286323**	**39.47361**	**-118.6639**	**4.2**
36043702	**D286547**	**39.50083**	**-118.6722**	**6.7**
36043750	**D286682**	**39.53278**	**-118.6486**	**19**
36043800	**D286534**	**39.5875**	**-118.6642**	**4.7**
36043850	**D286285**	**39.63111**	**-118.6628**	**20**
36043900	**D286550**	**39.66**	**-118.6731**	**13**
36043901	**D286407**	**39.68972**	**-118.6439**	**6.9**
36043950	**D286551**	**39.71778**	**-118.6481**	**6.2**
36043951	**D286645**	**39.71**	**-118.6531**	**12**
36044050	**D286303**	**39.82361**	**-118.6778**	**25**
36044100	**D286566**	**39.85028**	**-118.6794**	**19**
36044150	**D286624**	**39.87056**	**-118.6467**	**29**
36543450	**D286639**	**39.25528**	**-118.6061**	**4.9**
36543451	**D286731**	**39.27222**	**-118.6164**	**21**
36543500	**D286375**	**39.31889**	**-118.5783**	**15**
36543550	**D286277**	**39.36222**	**-118.5953**	**11**
36543600	**D286569**	**39.40445**	**-118.5997**	**4.5**
36543650	**D286647**	**39.45639**	**-118.6006**	**21**

36543700	**D286330**	**39.49166**	**-118.5939**	**19**
36543701	**D286523**	**39.48389**	**-118.5922**	**8.8**
36543750	**D286439**	**39.54055**	**-118.6031**	**5.1**
36543800	**D286539**	**39.58917**	**-118.6078**	**6.6**
36543900	**D286648**	**39.67056**	**-118.6158**	**15**
36543950	**D286521**	**39.70278**	**-118.6183**	**8.1**
36544100	**D286421**	**39.85111**	**-118.6369**	**32**
36544101	**D286509**	**39.86945**	**-118.6108**	**20**
36544150	**D286441**	**39.89194**	**-118.5997**	**34**
37043450	**D286451**	**39.2775**	**-118.5139**	**4.8**
37043500	**D286280**	**39.30556**	**-118.5381**	**8.4**
37043550	**D286325**	**39.35889**	**-118.5222**	**6**
37043551	**D286290**	**39.35472**	**-118.5497**	**15**
37043601	**D286630**	**39.39083**	**-118.5306**	**13**
37043650	**D286631**	**39.46167**	**-118.5378**	**10**
37043651	**D286681**	**39.44389**	**-118.5608**	**25**
37043700	**D286561**	**39.495**	**-118.5353**	**16**
37043750	**D286300**	**39.54306**	**-118.5489**	**20**
37043751	**D286472**	**39.51445**	**-118.5597**	**16**
37043800	**D286502**	**39.57833**	**-118.5519**	**22**
37043850	**D286643**	**39.63583**	**-118.5297**	**9.7**
37043851	**D286574**	**39.61444**	**-118.5267**	**14**
37043852	**D286341**	**39.61055**	**-118.5394**	**19**
37043853	**D286507**	**39.60972**	**-118.5258**	**22**
37043900	**D286535**	**39.67556**	**-118.54**	**34**
37043950	**D286626**	**39.70028**	**-118.5411**	**11**
37044150	**D286326**	**39.91195**	**-118.5719**	**45**
37044151	**D286582**	**39.90333**	**-118.535**	**16**
37044200	**D286638**	**39.93028**	**-118.5392**	**37**
37543350	**D286482**	**39.18056**	**-118.4494**	**7.2**
37543400	**D286495**	**39.23695**	**-118.4839**	**5.5**
37543401	**D286483**	**39.21583**	**-118.4653**	**3.9**
37543450	**D286383**	**39.26361**	**-118.4917**	**9**
37543451	**D286486**	**39.2625**	**-118.4531**	**4.9**
37543500	**D286464**	**39.31**	**-118.4786**	**16**
37543501	**D286299**	**39.29583**	**-118.4769**	**8.5**
37543550	**D286481**	**39.35361**	**-118.4914**	**3.4**
37543600	**D286282**	**39.38694**	**-118.4964**	**4.2**
37543650	**D286465**	**39.45222**	**-118.5025**	**5.3**
37543700	**D286659**	**39.50083**	**-118.4894**	**8.6**
37543750	**D286497**	**39.54028**	**-118.4814**	**13**

37543751	**D286294**	**39.54361**	**-118.5067**	**21**
37543800	**D286485**	**39.59333**	**-118.4786**	**13**
37543850	**D286395**	**39.62639**	**-118.4906**	**16**
37543851	**D286436**	**39.62**	**-118.5094**	**14**
37543852	**D286694**	**39.62778**	**-118.4981**	**23**
37543853	**D286642**	**39.60889**	**-118.4939**	**22**
37543900	**D286423**	**39.68083**	**-118.4631**	**14**
37543901	**D286345**	**39.66472**	**-118.4911**	**15**
37543950	**D286403**	**39.70472**	**-118.5019**	**9**
37544150	**D286414**	**39.89861**	**-118.4972**	**17**
37544200	**D286501**	**39.93306**	**-118.4764**	**16**
38043350	**D286386**	**39.19944**	**-118.4158**	**3.8**
38043400	**D286722**	**39.23778**	**-118.4075**	**5**
38043450	**D286367**	**39.25778**	**-118.4078**	**4.7**
38043451	**D286608**	**39.28194**	**-118.4356**	**16**
38043500	**D286499**	**39.31278**	**-118.43**	**4.4**
38043750	**D286633**	**39.54722**	**-118.4247**	**9.5**
38043800	**D286406**	**39.595**	**-118.4203**	**18**
38043850	**D286412**	**39.62361**	**-118.4311**	**18**
38043900	**D286319**	**39.68889**	**-118.4153**	**15**
38043901	**D286549**	**39.65194**	**-118.4581**	**13**
38043950	**D286691**	**39.71528**	**-118.4092**	**3.8**
38044000	**D286704**	**39.77056**	**-118.4189**	**13**
38044100	**D286462**	**39.84806**	**-118.4267**	**17**
38044150	**D286437**	**39.90556**	**-118.4389**	**20**
38044200	**D286604**	**39.9425**	**-118.4414**	**15**
38044250	**D286559**	**39.97194**	**-118.4322**	**16**
38543800	**D286580**	**39.58917**	**-118.3692**	**15**
38543850	**D286653**	**39.6375**	**-118.3878**	**44**
38543900	**D286576**	**39.66639**	**-118.3525**	**21**
38544000	**D286478**	**39.7825**	**-118.3703**	**12**
38544050	**D286530**	**39.81639**	**-118.3686**	**20**
38544100	**D286346**	**39.86639**	**-118.3639**	**16**
38544150	**D286394**	**39.89806**	**-118.3725**	**18**
38544200	**D286727**	**39.94305**	**-118.3811**	**15**
38544250	**D286396**	**39.98528**	**-118.3681**	**13**
39043850	**D286632**	**39.63306**	**-118.3339**	**15**
39043900	**D286351**	**39.68361**	**-118.3314**	**19**
39043950	**D286324**	**39.71611**	**-118.3161**	**11**
39044000	**D286506**	**39.76139**	**-118.3186**	**15**
39044050	**D286641**	**39.81805**	**-118.3097**	**18**

39044051	**D286487**	**39.80861**	**-118.3417**	**11**
39044100	**D286600**	**39.8625**	**-118.3144**	**14**
39044150	**D286422**	**39.89806**	**-118.3228**	**6.8**
39044200	**D286461**	**39.94305**	**-118.3147**	**11**
39044250	**D286491**	**39.98528**	**-118.3061**	**8.5**
39044300	**D286667**	**40.02861**	**-118.3169**	**21**
39433050	**D286427**	**39.81639**	**-118.2739**	**9.4**
39543950	**D286339**	**39.74361**	**-118.2844**	**21**
39544000	**D286281**	**39.77972**	**-118.2633**	**17**
39544051	**D286595**	**39.83333**	**-118.2297**	**42**
39544100	**D286304**	**39.86**	**-118.2628**	**8.6**
39544101	**D286368**	**39.84472**	**-118.2428**	**21**
39544150	**D286656**	**39.90833**	**-118.2708**	**12**
39544200	**D286336**	**39.94528**	**-118.2658**	**16**
39544250	**D286385**	**39.99972**	**-118.2681**	**9.1**
39544300	**D286601**	**40.04472**	**-118.2672**	**18**
39544350	**D286435**	**40.08583**	**-118.2672**	**16**
39544351	**D286337**	**40.08583**	**-118.2864**	**9.6**
39544400	**D286357**	**40.13083**	**-118.2678**	**13**
39544450	**D286453**	**40.15833**	**-118.2408**	**47**
40044100	**D286297**	**39.87833**	**-118.2203**	**11**
40044150	**D286715**	**39.90556**	**-118.2192**	**7**
40044200	**D286542**	**39.93361**	**-118.2089**	**7.3**
40044250	**D286524**	**39.99639**	**-118.1875**	**11**
40044251	**D286355**	**39.97167**	**-118.2086**	**13**
40044300	**D286545**	**40.03556**	**-118.1875**	**19**
40044301	**D286663**	**40.04667**	**-118.225**	**18**
40044350	**D286474**	**40.08583**	**-118.2069**	**11**
40044400	**D286526**	**40.14222**	**-118.1969**	**31**
40044401	**D286398**	**40.10778**	**-118.1828**	**13**
40044402	**D286734**	**40.12472**	**-118.1928**	**24**
40044450	**D286315**	**40.15833**	**-118.2178**	**31**