Snohomish County
Public Works
Solid Waste Management Division
Environmental Services Section

Aaron Reardon
County Executive

(425) 388-7654
FAX (360) 668-3944

Bldg. K
8915 Cathcart Way
Snohomish, WA 98296

January 22, 2009

Snohomish Health District
Attn. Gary Hanada
3020 Rucker Avenue, Suite 102
Everett, WA 98201-3971

RE: Lake Goodwin Groundwater Report, Annual Report 2008

Dear Gary,

The Lake Goodwin Landfill (Figure 1) groundwater samples for 2008 were collected and analyzed per the Environmental Monitoring Manual (EMM). Attached to this report is electronic laboratory data in tabular form (DUMPStat format). This data was also statistically analyzed for significant trends, prediction intervals, and nonparametric limits (see attached).

All samples were collected by Snohomish County employees without incident following the procedures listed in the Snohomish County Environmental Monitoring Manual. After measuring water levels, the wells were purged, field tested, and sampled using properly calibrated and decontaminated equipment. All wells were purged three pore volumes or dry before being sampled. Samples were properly preserved, placed on ice, and shipped maintaining proper chain of command procedures.

HYDROLOGY

Water depths (Appendix A) were converted to mean sea level (MSL) and plotted by hand on the site map. The Advanced Outwash aquifer indicates a northeasterly flow (Appendix B). Please note the apparent trough that flows from southwest towards the north under the landfill.

Linear horizontal groundwater velocity and direction were also calculated by computer. Groundwater elevations and coordinates were fed into a program designed by In-Situ Inc. (WATER-VEL Version 2.21). The following assumptions were made for the modeling program:

- The aquifer was assumed to have an average isotopic horizontal hydraulic conductivity of 83.30 ft/d (Converse Hydrogeologic Study, July 1991).
- The aquifer was assumed to have an effective porosity of 20.0% (Converse Hydrogeologic Study, July 1991).

The annual average aquifer results (Table C) indicate a flow velocity of 470 ft/yr at 16.03°, which generally match the hand-drawn maps (Appendix B).

GROUNDWATER CHEMICAL DATA QUALITY

Groundwater data was compared to MCL's (Maximum Contaminant Levels). Please refer to attached table for a summary of MCL failures (Appendix D). It is apparent that the landfill is releasing minor concentrations of contaminants into the Advanced Outwash Aquifer. Please note there were no VOC hits this year (Appendix E).

STATISTICAL CALCULATIONS

The Minimum Functional Standards require that applicable data from both upgradient reference wells and downgradient wells be evaluated to detect changes in groundwater quality. The amount of change, or whether it is significant, is determined using statistical procedures. Although no specific test is required by the regulations, a performance standard is presented in WAC 173-304-490(2)(f) and additional statistical information is presented in Ecology 1992 and EPA 2004.

Statistics were calculated separately on the required groundwater monitoring parameters for the deep groundwater zone. The statistical approach used by SWMD for comparison of upgradient vs. downgradient data is a prediction limit (PL) approach. Quarterly groundwater analytical data from the landfill are validated and entered into the DUMPStat software [version 2.1.8 (Robert D. Gibbons Ltd. 2000)] database, and the time series plots are prepared from the DUMPStat software. A complete discussion of the statistical evaluation process and DUMPStat program is provided in the SAP (Landau Associates 2006).

POWER CURVE

Each time the DUMPStat program calculates statistics on groundwater data it is also capable of performing a statistical power curve. This power curves represents two tests that: 1) determine the site-wide false positive rate (i.e., the percentage of failures when the background versus current true mean difference equals zero); and 2) determine the false negative rates for effect sizes ranging from 1 to 5 standard deviation units. A power curve will be provided for each quarterly testing period (Appendix F). The vertical scale (Y-axis) represents two different percentage ranges depending upon the value of the standard deviation (S.D.) unit. When the S.D. is equal to zero, the Y-axis represents the site wide false positive rate. If the S.D. is greater than zero, then the Y-axis represents the

false negative rate. This chart provides a graphical representation of the statistical power provided by the chosen statistical methods.

All general chemistry data was statistically analyzed using DUMPStat after careful QA/QC procedures. The program performed the following subroutines during analysis:

- Screened data for outliers
- Computed detection frequency
- Detected historical trends
- Selected optimal form of prediction limit

The program reports statistical results via two outputs: 1) tables that summarize the population (N), mean, standard deviation (SD), factor, and up vs. down prediction limit; and 2) graphs that summarize data and statistical results. A table summarizing statistical calculations is included in this report (Appendix G). Graphs that contain statistical warnings or failures are also included (Appendix H).

Graphs that indicate a failure (i.e., have a stamp marked failure) can be caused by several conditions. Any type of failure is cause for concern, but these are especially important because they are statistically significant.

- Verified Hit in Results: This type of failure indicates that two consecutive samples were over a prediction limit (when a one of one re-sampling protocol is being used).
- Significant Trend in Background Data: This type of failure indicates that a statistically significant long-term upward trend is indicated. It is considered a failure even if the data is below a prediction limit.
- Nonparametric Limit: This type of failure indicates that a nonparametric prediction limit was exceeded by a sample. This type of failure does not require verification to be considered a failure.

WATER CHEMISTRY SUMMARY

The water chemistry results for Lake Goodwin indicate monitored constituents exceeded MCLs and up vs.down prediction limits . Attached is a summary of these failures by quarter (Appendix I) :

CONCLUSIONS

Background conditions indicate an upgradient nitrate-n source is polluting the aquifer. The landfill is producing dilute leachate that is being carried in a northeasterly direction at a moderate rate. Please note no VOC's were detected this year. The only constituents that exceeded secondary MCL's were pH, TDS, and specific conductance. The only primary MCLs that exceeded their limits where arsenic and nitrate. Since most problematic contaminants are well below their respective MCL limits, it is unlikely this site poses a health risk to nearby residents.

RECOMMENDATIONS

This landfill has been very stable, both physically and geochemically. All modes of monitoring data indicate the landfill is approaching an inert state. Snohomish County proposes to continue the current groundwater monitoring program, maintaining the quarterly schedule for determining ground water elevations and collecting groundwater samples. The County further proposes to continue the preparation of an annual report, while deleting the preparation of quarterly reports. Please let me know if you have any questions or comments regarding this report. I can be reached at (425) 388-7651.

Sincerely,

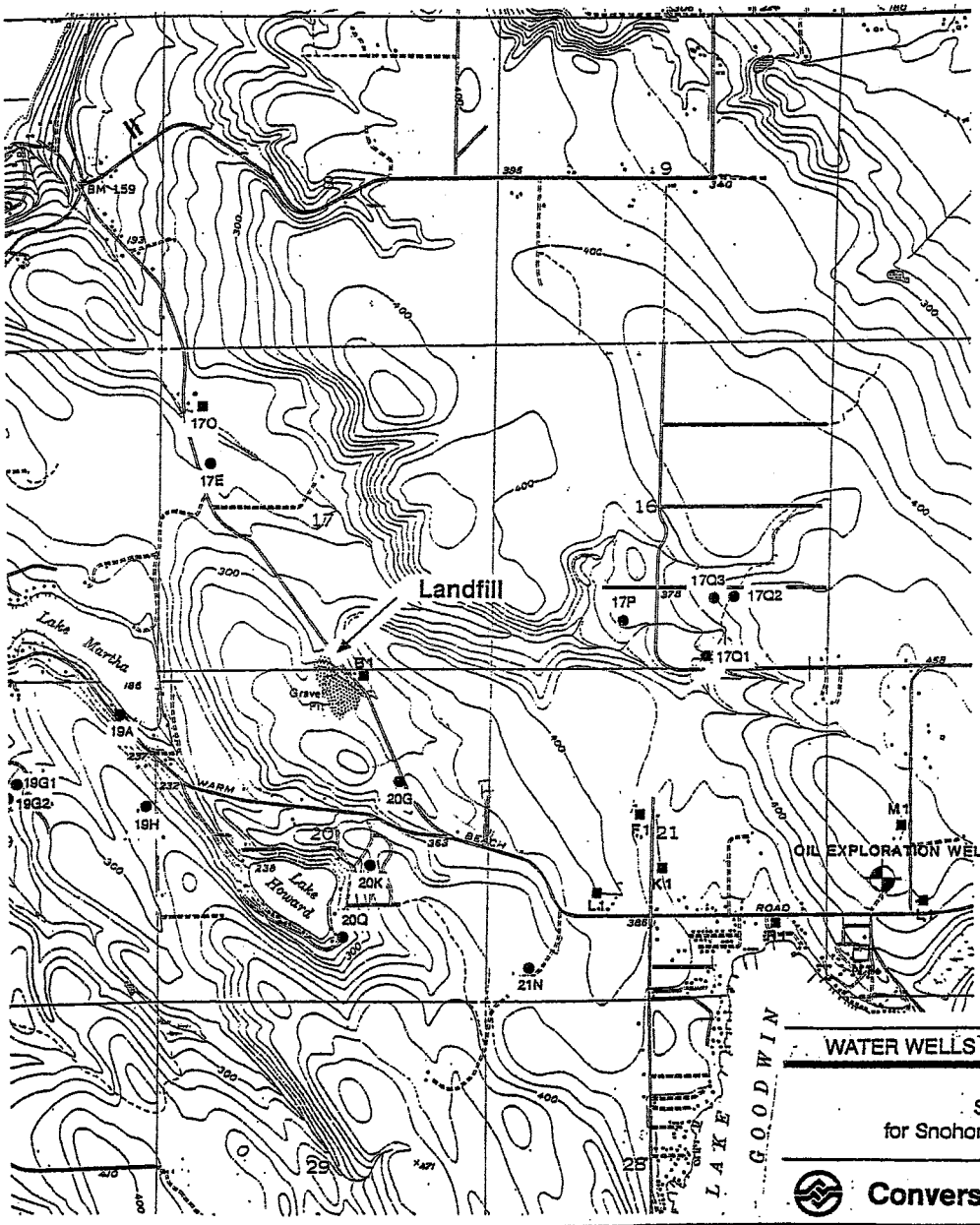
Neil Bresheare

Neil Bresheare
Environmental Monitoring Supervisor

TABLES

FIGURES

FIG 1



LEGEND

- APPROXIMATE WASTE FILL AREA
- 24 — APPROXIMATE LOCATION OF DRILLED WELL WITH DRILLER LOG
- L1 — APPROXIMATE LOCATION OF HAND DUG WELL (NEWCOMB 1952)
- M2 — APPROXIMATE LOCATION OF DRILLED WELL (NEWCOMB 1952)

REFERENCE: Base map compiled from portion of USGS 7 1/2' STANWOOD, WASHINGTON QUADRANGLE

1 2000 FEET
SCALE

WATER WELLS IN VICINITY OF LAKE GOODWIN LANDFILL

LAKE GOODWIN LANDFILL
Snohomish County, Washington
for Snohomish County Department of Public Works

Project No. 89-352

Figure No:

Converse Consultants NW Geotechnical Engineering and Applied Earth Sciences

APPENDIX A

151 4/K

Snohomish County Solid Waste
Environmental Services Section
8915 Cathcart Way
Snohomish, WA 98296
Tel: (360) 668-6595

GROUND WATER ELEVATIONS

Lk Goodwin

Location	Aquifer	Date	MSL Water Elev (Ft)
LG-01	D	1/16/2008	149.37
LG-02	D	1/16/2008	152.17
LG-03	D	1/16/2008	149.78
LG-04	D	1/16/2008	148.78
LG-05	D	1/16/2008	149.44

2 ND QTR
2008

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GROUND WATER ELEVATIONS

Lk Goodwin

Location	Aquifer	Date	MSL Water Elev (Ft)
LG-01	D	4/9/2008	151.90
LG-02	D	4/9/2008	151.50
LG-03	D	4/9/2008	155.88
LG-04	D	4/9/2008	150.40
LG-05	D	4/9/2008	149.28

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3RD QTR

GROUND WATER ELEVATIONS

Lk Goodwin

Location	Aquifer	Date	MSL Water Elev (Ft)
LG-01	D	7/16/2008	152.95
LG-02	D	7/16/2008	151.71
LG-03	D	7/16/2008	152.91
LG-04	D	7/16/2008	149.77
LG-05	D	7/16/2008	149.45

4TH QTR 2008

Snohomish County Solid Waste
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8915 Cathcart Way
Snohomish, WA 98296
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GROUND WATER ELEVATIONS

Lk Goodwin

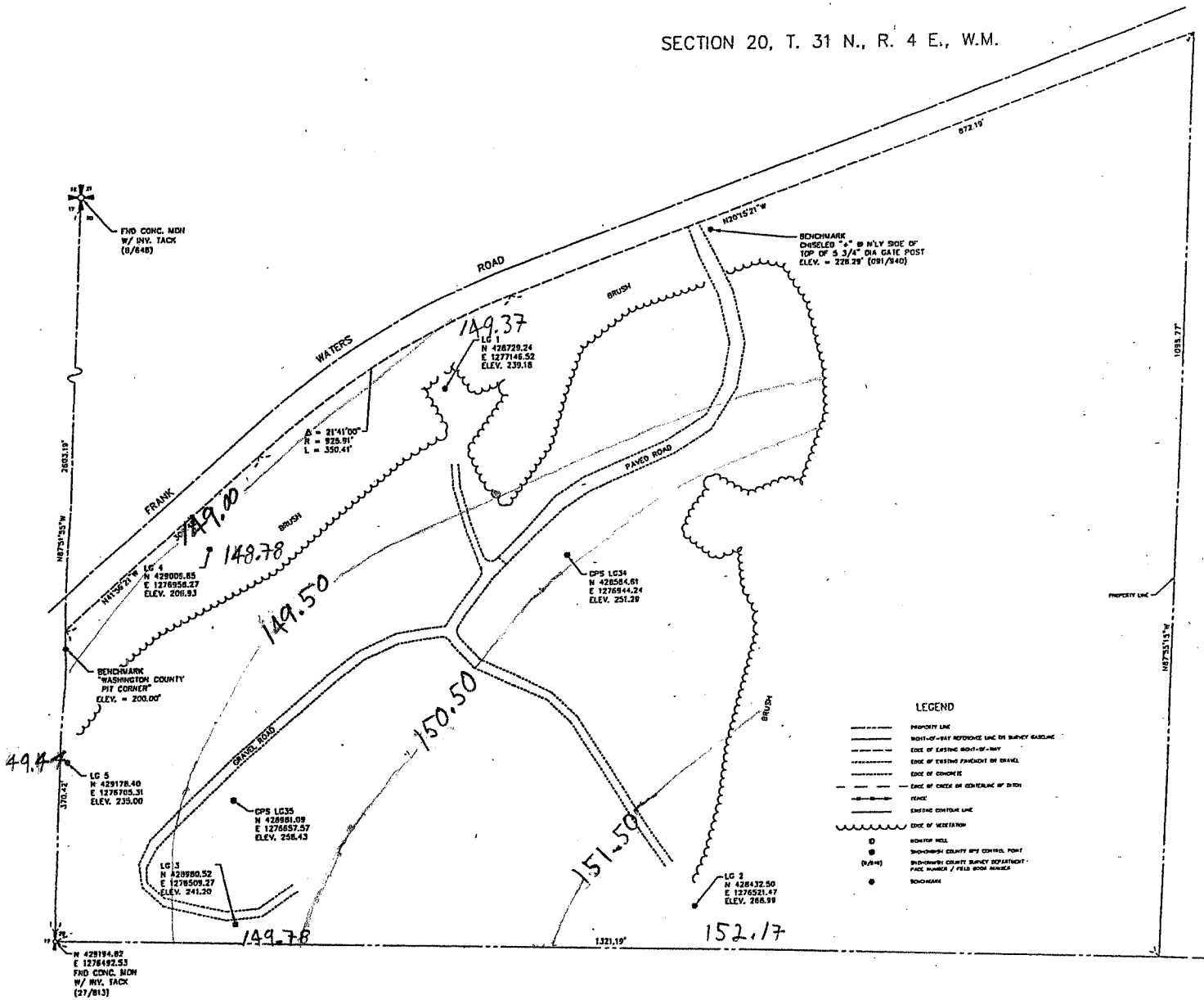
Location	Aquifer	Date	MSL Water Elev (Ft)
LG-01	D	10/28/2008	150.35
LG-02	D	10/28/2008	149.84
LG-03	D	10/28/2008	149.48
LG-04	D	10/28/2008	148.83
LG-05	D	10/28/2008	149.04

APPENDIX B

1ST QTR

L G. 1/16/2008

SECTION 20, T. 31 N., R. 4 E., W.M.



NOTES:

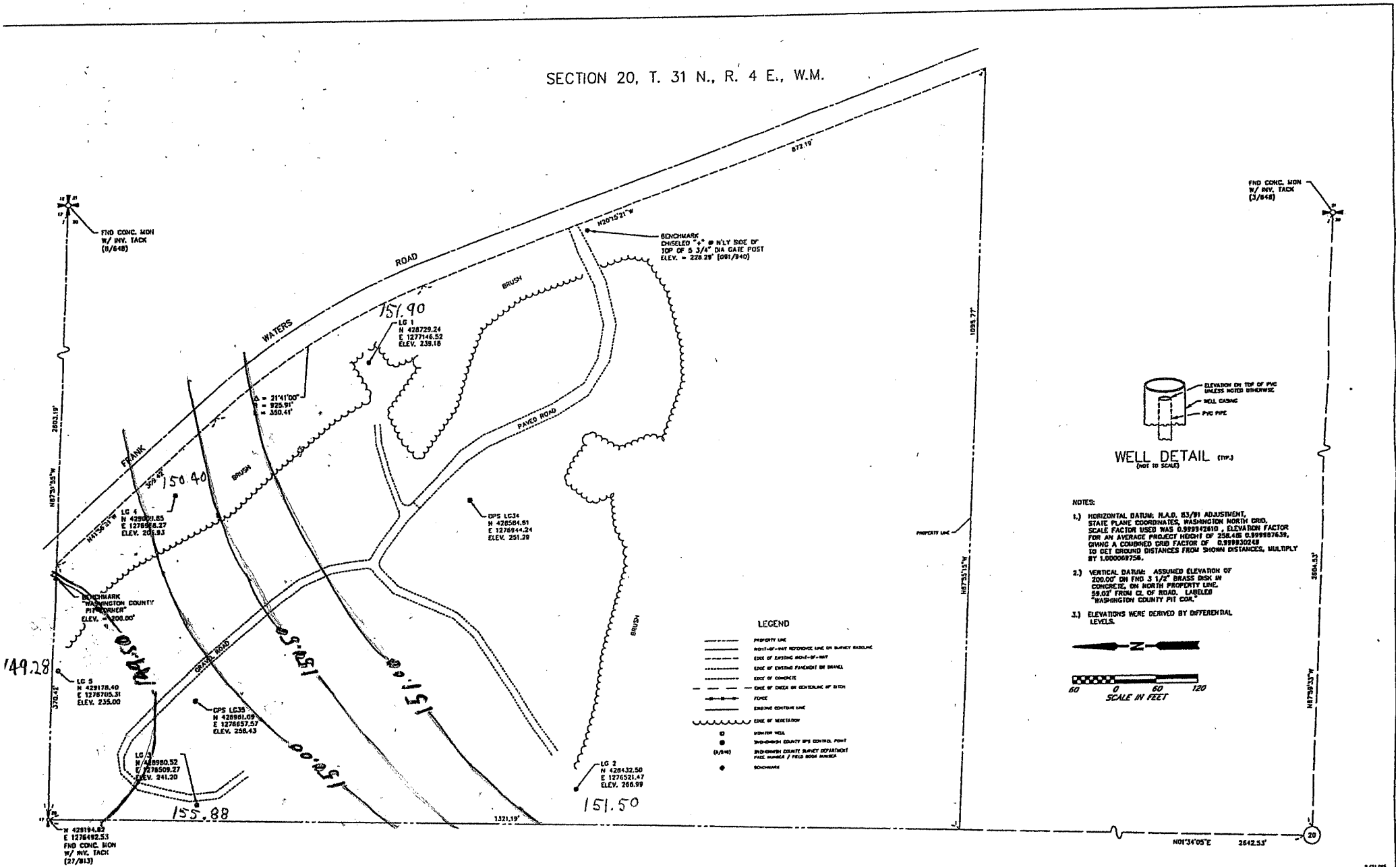
1.) HORIZONTAL DATUM: N.A.D. 83/91 ADJUSTMENT, STATE PLANE COORDINATES, WASHINGTON NORTH GRID. SCALE FACTOR USED WAS 0.999942610 , ELEVATION FACTOR FOR AN AVERAGE PROJECT HEIGHT OF 258.485 0.999987639, GIVING A COMBINED GRID FACTOR OF 0.999930249 TO GET GROUND DISTANCES FROM SHOWN DISTANCES, MULTIPLY BY 1.000069758.

2.) VERTICAL DATUM: ASSUMED ELEVATION OF 200.00' ON FND 3 1/2" BRASS DISK IN CONCRETE, ON NORTH PROPERTY LINE. 59.02' FROM CL OF ROAD. LABELED "WASHINGTON COUNTY PIT COR."

3.) ELEVATIONS WERE DERIVED BY DIFFERENTIAL LEVELS.

SNOHOMISH COUNTY DEPARTMENT OF PUBLIC WORKS	LAKE GOODWIN LANDFILL MONITORING WELLS	SURVEY NO. 3059	3/21/95 3059-B3.DWG
		SHEET 1 OF	

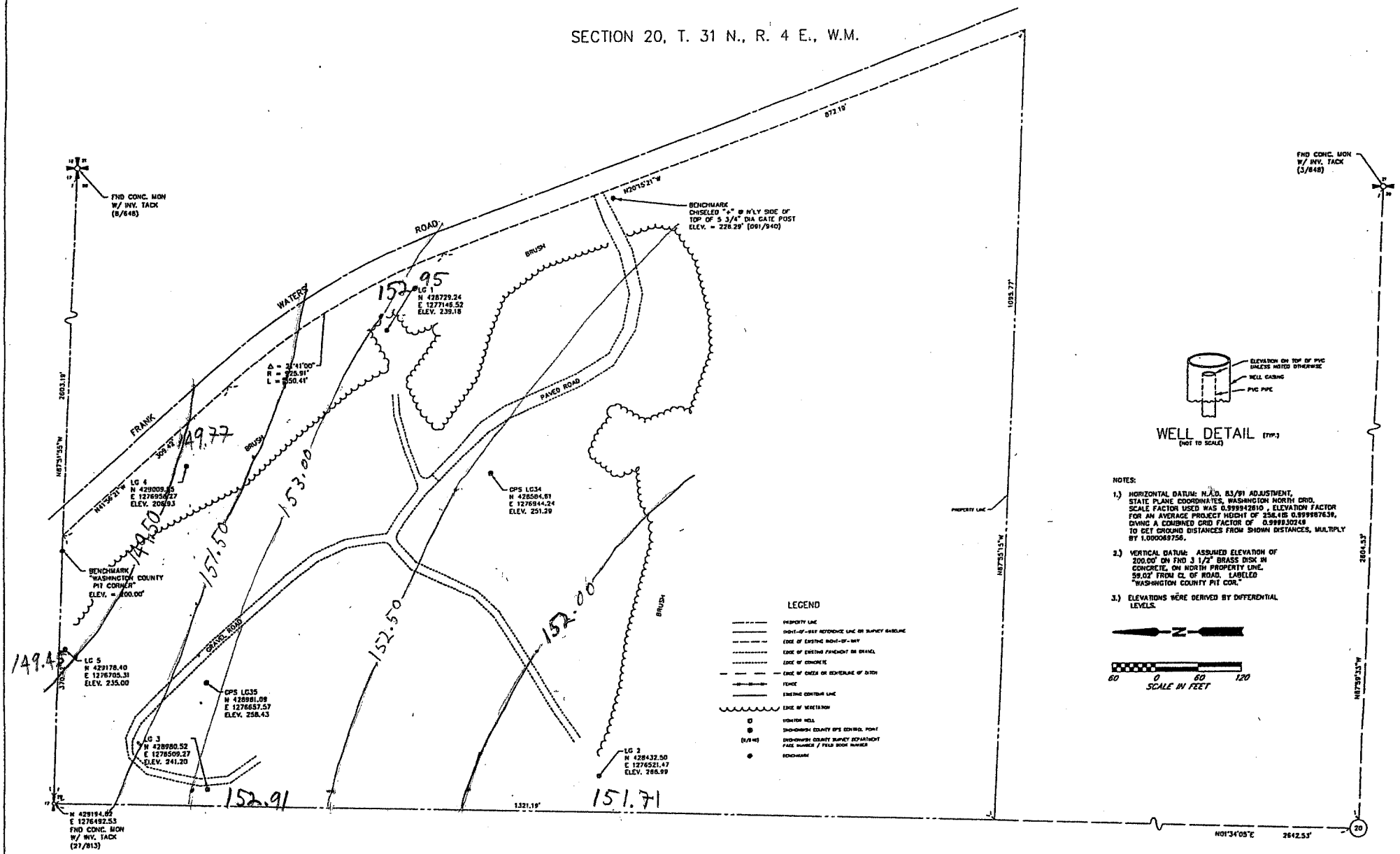
LNU 4/12 2000



SNOHOMISH COUNTY DEPARTMENT OF PUBLIC WORKS	LAKE GOODWIN LANDFILL MONITORING WELLS		SURVEY NO. 3069
BASE MAP BY: J. CSISEK	FIELD BOOK(S): 648,809,811,940	PROJECT NO. 89-431	SHEET 1 OF 1 SHEETS

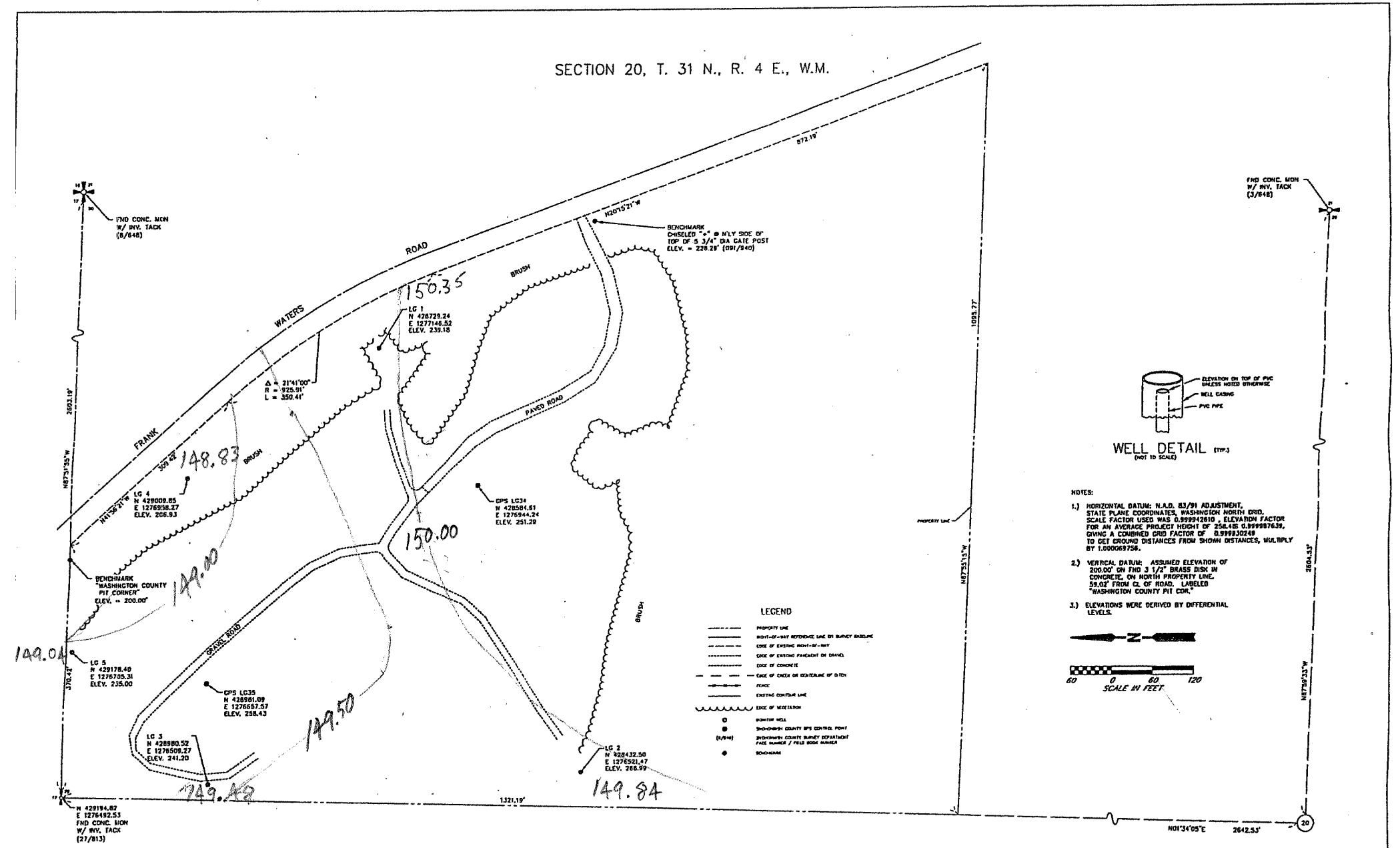
3/21/95
3069-BASE

FIG. 2
3RD QTR
LG. 7-16-2008



SNOHOMISH COUNTY DEPARTMENT OF PUBLIC WORKS	LAKE GOODWIN LANDFILL MONITORING WELLS	SURVEY NO. 3069	2/21/95 3069-83.DWG
BASE MAP BY: J. CSISEK	FIELD BOOK(S): 648,809,811,940	PROJECT NO. 89-431	SHEET 1 OF 1 SHEETS

4TH QTR
2008



2/21/95
3069-83.DWG

SNOHOMISH COUNTY DEPARTMENT OF PUBLIC WORKS

BASE MAP BY: L. CRISSY | FIELD BOOK(S): 648 809 811 940

LAKE GOODWIN LANDFILL MONITORING WELLS

PROJECT NO. 89-431

SURVEY NO. 3069

SHEET 1 OF 1 SHEETS

APPENDIX C

1st Quarter 2008

In-Situ Inc. Groundwater Velocity Program (V2.21)

Lake Goodwin Deep Wells

Output file is : h:\ess\modeling\watervel\lgdeep.prn
Input file is : h:\ess\modeling\watervel\lgdeep.txt

Isotropic hydraulic cond. = 83.30 ft/d
Effective porosity = 20.00 %

Least squares match to groundwater table:

N	X(ft)	Y(ft)	Meas. head (ft)	Calc. head (ft)
1	646.57	299.26	149.37	149.40
2	21.47	2.50	152.17	152.01
3	9.27	550.56	149.78	150.19
4	458.30	579.89	148.78	148.93
5	205.32	748.45	149.44	149.01

Calc. Head (ft) = -2.574E-03*X - 3.386E-03*Y + 1.521E+02

Natural groundwater flow = 1.77E+00 ft/day (6.47E+02 ft/yr)
at 52.76 deg to the positive X-axis

WATER-VEL COMPLETED.

2nd Quarter 2008

In-Situ Inc. Groundwater Velocity Program (V2.21)

Lake Goodwin Deep Wells

Output file is : h:\ess\modeling\watervel\lgdeep.prn
Input file is : h:\ess\modeling\watervel\lgdeep.txt

Isotropic hydraulic cond. = 83.30 ft/d
Effective porosity = 20.00 %

Least squares match to groundwater table:

N	X(ft)	Y(ft)	Meas. head (ft)	Calc. head (ft)
1	646.57	299.26	151.90	150.67
2	21.47	2.50	151.50	152.98
3	9.27	550.56	155.88	152.54
4	458.30	579.89	150.40	151.04
5	205.32	748.45	149.28	151.73

Calc. Head (ft) = -3.288E-03*X - 8.746E-04*Y + 1.531E+02

Natural groundwater flow = 1.42E+00 ft/day (5.17E+02 ft/yr)
at 14.89 deg to the positive X-axis

WATER-VEL COMPLETED.

TABLE #2
3RD QTR

3rd Quarter 2008

In-Situ Inc. Groundwater Velocity Program (V2.21)

Lake Goodwin Deep Wells

Output file is : h:\ess\modeling\watervel\lgdeep.prn
Input file is : h:\ess\modeling\watervel\lgdeep.txt

Isotropic hydraulic cond. = 83.30 ft/d
Effective porosity = 20.00 %

Least squares match to groundwater table:

N	X(ft)	Y(ft)	Meas. head (ft)	Calc. head (ft)
1	646.57	299.26	152.95	151.81
2	21.47	2.50	151.71	152.64
3	9.27	550.56	152.91	150.99
4	458.30	579.89	149.77	150.94
5	205.32	748.45	149.45	150.41

Calc. Head (ft) = 1.034E-04*X - 3.019E-03*Y + 1.526E+02

Natural groundwater flow = 1.26E+00 ft/day (4.59E+02 ft/yr)
at 91.96 deg to the positive X-axis

WATER-VEL COMPLETED.

4th Quarter 2008

In-Situ Inc. Groundwater Velocity Program (V2.21)

Lake Goodwin Deep Wells

Output file is : h:\ess\modeling\watervel\lgdeep.prn
Input file is : h:\ess\modeling\watervel\lgdeep.txt

Isotropic hydraulic cond. = 83.30 ft/d
Effective porosity = 20.00 %

Least squares match to groundwater table:

N	X(ft)	Y(ft)	Meas. head (ft)	Calc. head (ft)
1	646.57	299.26	150.35	149.96
2	21.47	2.50	149.84	150.03
3	9.27	550.56	149.48	149.17
4	458.30	579.89	148.83	149.40
5	205.32	748.45	149.04	148.98

Calc. Head (ft) = 6.309E-04*X - 1.559E-03*Y + 1.500E+02

Natural groundwater flow = 7.00E-01 ft/day (2.56E+02 ft/yr)
at 112.03 deg to the positive X-axis

WATER-VEL COMPLETED.

APPENDIX D

Snohomish County Solid Waste
Environmental Services Section
8915 Cathcart Way
Snohomish, WA 98296 Tel: (360) 668-6595

WAC Cleanup Level

Lk Goodwin

15-Jan-09 **Report Date Range - From:** 1/1/2008 **To:** 3/31/2008

Constituent	Location	Date	WAC Cleanup Level	Result	Units
Arsenic, Dissolved	LG-02	1/16/2008	0.001	0.004	mg/l
Chloroform	LG-99	1/16/2008	7	26.5	ug/l
Conductivity	LG-03	1/16/2008	700	750	umhos/cm
	LG-03	1/16/2008	700	760	umhos/cm
Nitrate Nitrogen	LG-05	1/16/2008	10	12	mg/l
pH	LG-04	1/16/2008	< 6.5 OR > 8.5	6.42	std units
	LG-05	1/16/2008	< 6.5 OR > 8.5	6.47	std units

Snohomish County Solid Waste
Environmental Services Section
8915 Cathcart Way
Snohomish, WA 98296 Tel: (360) 668-6595

WAC Cleanup Level

Lk Goodwin

15-Jan-09 **Report Date Range - From:** 4/1/2008 **To:** 6/30/2008

Constituent	Location	Date	WAC Cleanup Level	Result	Units
Arsenic, Dissolved	LG-02	4/9/2008	0.001	0.004	mg/l
Conductivity	LG-03	4/9/2008	700	820	umhos/cm
	LG-05	4/9/2008	700	800	umhos/cm
Nitrate Nitrogen	LG-05	4/9/2008	10	12	mg/l

Snohomish County Solid Waste
Environmental Services Section
8915 Cathcart Way
Snohomish, WA 98296 Tel: (360) 668-6595

WAC Cleanup Level

lk Goodwin

15-Jan-09 **Report Date Range - From:** 7/1/2008 **To:** 9/30/2008

Constituent	Location	Date	WAC Cleanup Level	Result	Units
Arsenic, Dissolved	LG-02	7/16/2008	0.001	0.004	mg/l
Conductivity	LG-03	7/16/2008	700	940	umhos/cm
	LG-03	7/16/2008	700	910	umhos/cm
pH	LG-01	7/16/2008	< 6.5 OR > 8.5	6.46	std units
	LG-02	7/16/2008	< 6.5 OR > 8.5	6.39	std units
	LG-03	7/16/2008	< 6.5 OR > 8.5	6.3	std units
	LG-04	7/16/2008	< 6.5 OR > 8.5	6.35	std units
	LG-05	7/16/2008	< 6.5 OR > 8.5	6.24	std units
Total Dissolved Solids	LG-03	7/16/2008	500	590	mg/l
	LG-03	7/16/2008	500	600	mg/l

Snohomish County Solid Waste
Environmental Services Section
8915 Cathcart Way
Snohomish, WA 98296 Tel: (360) 668-6595

WAC Cleanup Level

Lk Goodwin

15-Jan-09 **Report Date Range - From:** 10/1/2008 **To:** 12/31/2008

Constituent	Location	Date	WAC Cleanup Level	Result	Units
Arsenic, Dissolved	LG-02	10/28/2008	0.001	0.004	mg/l
	LG-03	10/28/2008	0.001	0.002	mg/l
Conductivity	LG-03	10/28/2008	700	950	umhos/cm
	LG-05	10/28/2008	700	720	umhos/cm
Nitrate Nitrogen	LG-05	10/28/2008	10	12	mg/l
	LG-05	10/28/2008	10	12	mg/l
Total Dissolved Solids	LG-03	10/28/2008	500	540	mg/l

APPENDIX E

Table 1

Historical Volatile Organic Compound Detections

Constituent	Units	Well	Date	Result	Limit
2-butanone	ug/L	LG-01	10/22/1998	110.0000	5.0000
4-methyl-2-pentanone (mibk)	ug/L	LG-01	10/22/1998	28.0000	3.0000
Acetone	ug/L	LG-01	12/27/1990	22.0000	2.0000
Acetone	ug/L	LG-01	5/18/1992	4.0000	2.0000
Acetone	ug/L	LG-01	10/21/1992	3.0000	2.0000
Acetone	ug/L	LG-01	10/22/1998	20.0000	2.0000
Benzene	ug/L	LG-01	7/08/1999	.9000	1.0000
Bromoform	ug/L	LG-01	4/12/2005	1.3000	1.0000
Carbon disulfide	ug/L	LG-01	5/09/1997	1.4000	1.0000
Ethylbenzene	ug/L	LG-01	7/08/1999	1.4000	1.0000
M,p-xylene	ug/L	LG-01	7/08/1999	1.7000	.4000
Methylene chloride	ug/L	LG-01	6/20/1991	1.0000	1.0000
Methylene chloride	ug/L	LG-01	5/18/1992	3.0000	1.0000
Methylene chloride	ug/L	LG-01	10/21/1992	4.0000	1.0000
Methylene chloride	ug/L	LG-01	3/22/1994	1.3000	1.0000
Methylene chloride	ug/L	LG-01	3/17/1995	1.6000	1.0000
Methylene chloride	ug/L	LG-01	11/14/1995	1.1000	1.0000
Toluene	ug/L	LG-01	10/22/1998	3.7000	1.0000
Toluene	ug/L	LG-01	7/08/1999	3.2000	1.0000
Toluene	ug/L	LG-01	7/08/1999	1.7000	1.0000
2-butanone	ug/L	LG-02	10/22/1998	370.0000	5.0000
4-methyl-2-pentanone (mibk)	ug/L	LG-02	10/22/1998	61.0000	3.0000
Acetone	ug/L	LG-02	12/27/1990	18.0000	2.0000
Acetone	ug/L	LG-02	10/22/1998	73.0000	2.0000
Bromoform	ug/L	LG-02	4/12/2005	1.4000	1.0000
Carbon disulfide	ug/L	LG-02	10/22/1998	2.3000	1.0000
Carbon disulfide	ug/L	LG-02	7/08/1999	23.0000	1.0000
Chloroform	ug/L	LG-02	1/27/2004	1.1000	1.0000
Methylene chloride	ug/L	LG-02	6/20/1991	3.0000	1.0000
Methylene chloride	ug/L	LG-02	5/18/1992	3.0000	1.0000
Methylene chloride	ug/L	LG-02	10/21/1992	3.0000	1.0000
Methylene chloride	ug/L	LG-02	3/17/1995	1.3000	1.0000
Methylene chloride	ug/L	LG-02	11/14/1995	1.2000	1.0000
Toluene	ug/L	LG-02	7/08/1999	1.0000	1.0000
1,1,2,2-tetrachloroethane	ug/L	LG-03	7/25/2007	1.1000	1.0000
Acetone	ug/L	LG-03	12/27/1990	13.0000	2.0000
Acetone	ug/L	LG-03	5/18/1992	3.0000	2.0000
Acetone	ug/L	LG-03	10/21/1992	4.0000	2.0000
Carbon disulfide	ug/L	LG-03	10/21/1992	1.0000	1.0000
Chloroform	ug/L	LG-03	1/27/2004	2.7000	1.0000
Methylene chloride	ug/L	LG-03	5/18/1992	2.0000	1.0000
Methylene chloride	ug/L	LG-03	10/21/1992	2.0000	1.0000
Methylene chloride	ug/L	LG-03	9/13/1994	2.0000	1.0000
Methylene chloride	ug/L	LG-03	10/25/1994	1.2000	1.0000
Methylene chloride	ug/L	LG-03	3/17/1995	1.1000	1.0000
Methylene chloride	ug/L	LG-03	11/14/1995	1.1000	1.0000
2-butanone	ug/L	LG-04	10/22/1998	15.0000	5.0000
Acetone	ug/L	LG-04	12/17/1990	3.0000	2.0000
Acetone	ug/L	LG-04	12/27/1990	59.0000	2.0000
Carbon disulfide	ug/L	LG-04	8/05/1997	1.5000	1.0000
Carbon disulfide	ug/L	LG-04	4/14/1998	2.0000	1.0000
Carbon disulfide	ug/L	LG-04	10/22/1998	1.1000	1.0000
Carbon disulfide	ug/L	LG-04	7/08/1999	4.8000	1.0000
Methylene chloride	ug/L	LG-04	5/18/1992	2.0000	1.0000
Methylene chloride	ug/L	LG-04	10/21/1992	3.0000	1.0000
Methylene chloride	ug/L	LG-04	9/13/1994	1.7000	1.0000
Methylene chloride	ug/L	LG-04	3/17/1995	1.2000	1.0000

Detections are shown for constituents selected in the VOC list and all selected wells
The Limit column refers to the laboratory reporting limit

Table 1

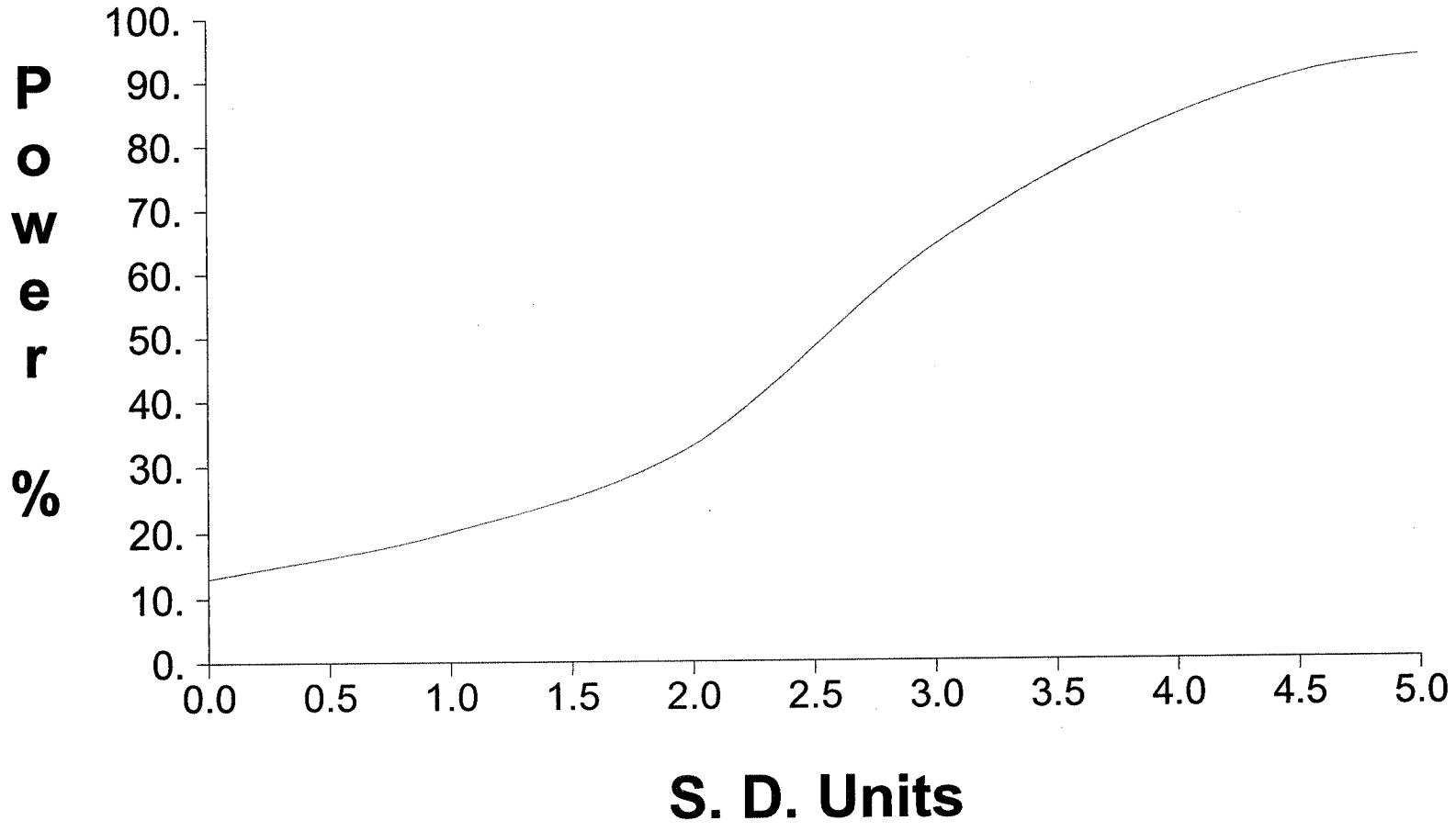
Historical Volatile Organic Compound Detections

Constituent	Units	Well	Date	Result	Limit
Methylene chloride	ug/L	LG-04	11/14/1995	1.2000	1.0000
2-butanone	ug/L	LG-05	10/22/1998	14.0000	5.0000
Acetone	ug/L	LG-05	5/07/2004	74.2000	2.0000
Carbon disulfide	ug/L	LG-05	10/21/1997	1.0000	1.0000
Methylene chloride	ug/L	LG-05	10/21/1992	3.0000	1.0000
Methylene chloride	ug/L	LG-05	3/22/1994	1.7000	1.0000
Methylene chloride	ug/L	LG-05	3/17/1995	1.3000	1.0000
Methylene chloride	ug/L	LG-05	11/14/1995	1.3000	1.0000
Styrene	ug/L	LG-05	11/26/1991	20.0000	1.0000

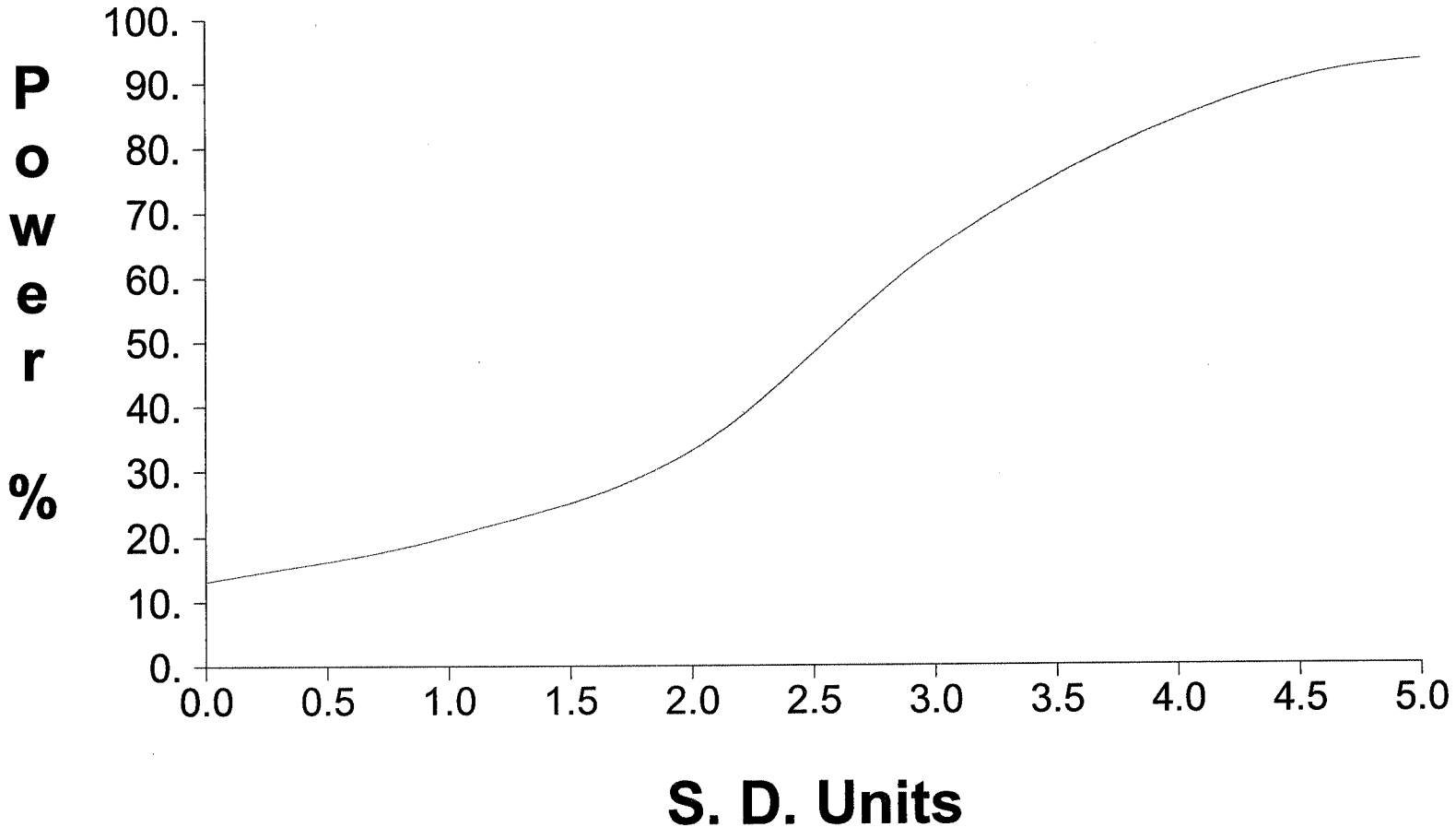
Detections are shown for constituents selected in the VOC list and all selected wells
The Limit column refers to the laboratory reporting limit

APPENDIX F

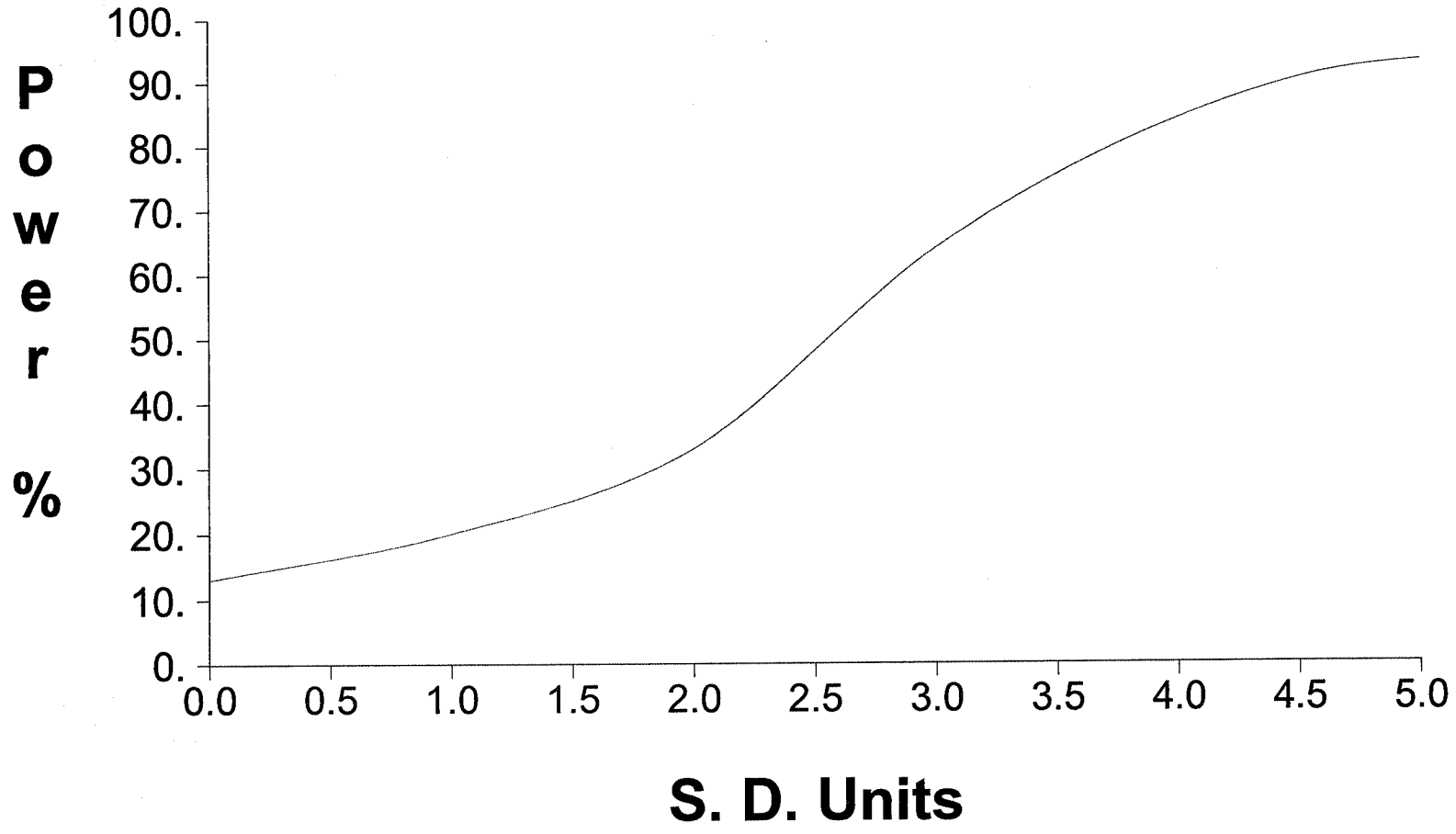
False Positive and False Negative Rates for Current Upgradient vs. Downgradient Monitoring Program



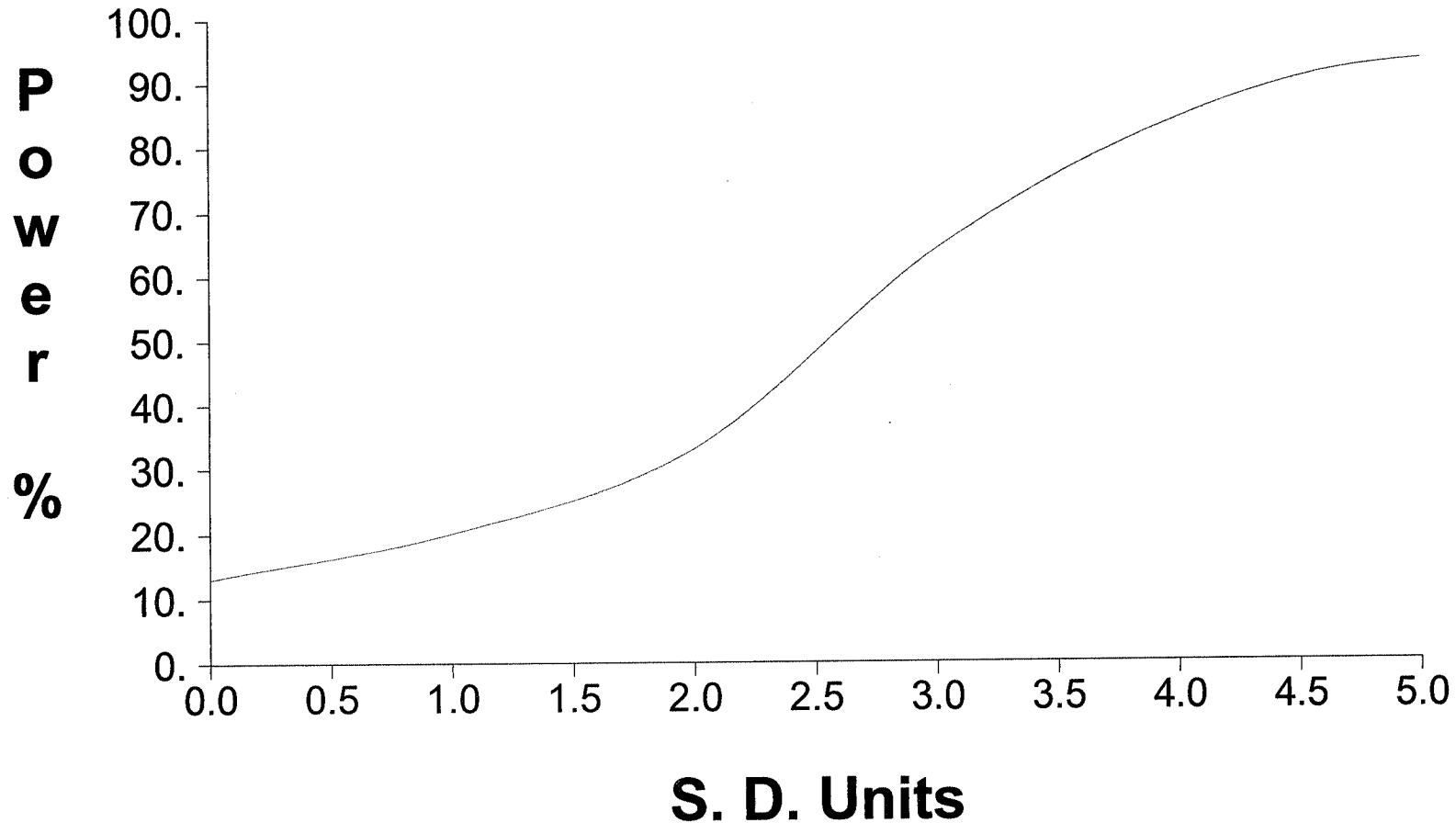
False Positive and False Negative Rates for Current Upgradient vs. Downgradient Monitoring Program



False Positive and False Negative Rates for Current Upgradient vs. Downgradient Monitoring Program



False Positive and False Negative Rates for Current Upgradient vs. Downgradient Monitoring Program



Prepared by: Snohomish County Solid Waste

APPENDIX G

Lk. Goodwin Landfill

Analysis prepared on: 1/22/2009

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Alkalinity (as caco3) (mg/L)
Normal Prediction Limit

Step	Equation	Description
1	$\bar{X}$ = **sum[X] / N** = **1738.0 / 19** = **91.474**	Compute upgradient mean.
2	S = ((**sum[X^2] - sum[X]^2/N**) / (**N-1**))$^{1/2}$ = ((**160708.0 - 3.02x10^6/19**) / (**19-1**))$^{1/2}$ = **9.794**	Compute upgradient sd.
3	alpha = min[(1-.95$^{1/K}$)$^{1/2}$ or .01] = min[(1-.95$^{1/140}$)$^{1/2}$ or .01] = **0.01**	Adjusted per comparison false positive rate. Pass initial or 1 resample.
4	PL = $\bar{X}$ + **tS**(1+1/N)$^{1/2}$ = **91.474** + (**2.551*9.794**)(1+1/**19**)$^{1/2}$ = **117.11**	One-sided normal prediction limit (t is Student's t on N-1 degrees of freedom and 1-alpha confidence level).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Ammonia-n (nh3) (mg/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = max(X) = **0.043**	Compute nonparametric prediction limit as largest background measurement.
2	Confidence = **0.982**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Antimony, dissolved (mg/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = median(X) = **0.01**	Compute nonparametric prediction limit as median reporting limit in background.
2	Confidence = **0.98**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Arsenic, dissolved (as) (mg/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = max(X) = **0.006**	Compute nonparametric prediction limit as largest background measurement.
2	Confidence = **0.983**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Barium, dissolved (ba) (mg/L)
Normal Prediction Limit

Step	Equation	Description
1	$\bar{X}$ = **sum[X] / N** = **0.183 / 20** = **0.009**	Compute upgradient mean.
2	S = ((**sum[X^2]** - **sum[X]^2/N**) / (**N**-1))^{½} = ((**0.002** - **0.034/20**) / (**20**-1))^{½} = **0.001**	Compute upgradient sd.
3	alpha = min[(1-.95$^{1/K}$)^{½} or .01] = min[(1-.95$^{1/140}$)^{½} or .01] = **0.01**	Adjusted per comparison false positive rate. Pass initial or 1 resample.
4	PL = $\bar{X}$ + **tS**(1+1/**N**)^{½} = **0.009** + (**2.538*****0.001**)(1+1/**20**)^{½} = **0.013**	One-sided normal prediction limit (t is Student's t on N-1 degrees of freedom and 1-alpha confidence level).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Beryllium, dissolved (mg/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = median(X) = **5.00×10^{-4}**	Compute nonparametric prediction limit as median reporting limit in background.
2	Confidence = **0.978**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Bicarbonate (mg/L)
Normal Prediction Limit

Step	Equation	Description
1	$\bar{X}$ = **sum[X] / N** = **1738.0 / 19** = **91.474**	Compute upgradient mean.
2	S = ((**sum[X^2] - sum[X]^2/N**) / (**N-1**))$^{1/2}$ = ((**160708.0 - 3.02x10^6/19**) / (**19-1**))$^{1/2}$ = **9.794**	Compute upgradient sd.
3	alpha = min[(1-.95$^{1/K}$)$^{1/2}$ or .01] = min[(1-.95$^{1/140}$)$^{1/2}$ or .01] = **0.01**	Adjusted per comparison false positive rate. Pass initial or 1 resample.
4	PL = $\bar{X}$ + **tS**(1+1/**N**)$^{1/2}$ = **91.474** + (**2.551*9.794**)(1+1/**19**)$^{1/2}$ = **117.11**	One-sided normal prediction limit (t is Student's t on N-1 degrees of freedom and 1-alpha confidence level).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Cadmium, dissolved (cd) (mg/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = max(X) = **1.30×10^{-4}**	Compute nonparametric prediction limit as largest background measurement.
2	Confidence = **0.982**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Calcium, dissolved (mg/L)
Normal Prediction Limit

Step	Equation	Description
1	$\bar{X}$ = **sum[X] / N** = **288.86 / 18** = **16.048**	Compute upgradient mean.
2	S = ((**sum[X^2]** - **sum[X]**^{2}/**N**) / (**N**-1))$^{1/2}$ = ((**4760.424 - 83440.1/18**) / (**18**-1))$^{1/2}$ = **2.71**	Compute upgradient sd.
3	alpha = min[(1-.95$^{1/K}$)$^{1/2}$ or .01] = min[(1-.95$^{1/140}$)$^{1/2}$ or .01] = **0.01**	Adjusted per comparison false positive rate. Pass initial or 1 resample.
4	PL = $\bar{X}$ + **t**S(1+1/**N**)$^{1/2}$ = **16.048** + (**2.565*****2.71**)(1+1/**18**)$^{1/2}$ = **23.191**	One-sided normal prediction limit (t is Student's t on N-1 degrees of freedom and 1-alpha confidence level).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Chloride (mg/L)
Normal Prediction Limit

Step	Equation	Description
1	$\bar{X}$ = **sum[X] / N** = **160.1 / 21** = **7.624**	Compute upgradient mean.
2	S = ((**sum[X^2] - sum[X]^2/N**) / (**N**-1))$^{1/2}$ = ((**1277.91 - 25632.01/21**) / (**21**-1))$^{1/2}$ = **1.693**	Compute upgradient sd.
3	alpha = min[(1-.95$^{1/K}$)$^{1/2}$ or .01] = min[(1-.95$^{1/140}$)$^{1/2}$ or .01] = **0.01**	Adjusted per comparison false positive rate. Pass initial or 1 resample.
4	PL = $\bar{X}$ + **t**S(1+1/**N**)$^{1/2}$ = **7.624** + (**2.527*****1.693**)(1+1/**21**)$^{1/2}$ = **12.003**	One-sided normal prediction limit (t is Student's t on N-1 degrees of freedom and 1-alpha confidence level).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Chromium, dissolved (cr) (mg/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = max(X) = **0.015**	Compute nonparametric prediction limit as largest background measurement.
2	Confidence = **0.983**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Cobalt, dissolved (mg/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = max(X) = **0.026**	Compute nonparametric prediction limit as largest background measurement.
2	Confidence = **0.98**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Copper, dissolved (cu) (mg/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = max(X) = **0.008**	Compute nonparametric prediction limit as largest background measurement.
2	Confidence = **0.982**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Iron, dissolved (fe) (mg/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = max(X) = **0.032**	Compute nonparametric prediction limit as largest background measurement.
2	Confidence = **0.983**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Lead, dissolved (pb) (mg/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = max(X) = **0.002**	Compute nonparametric prediction limit as largest background measurement.
2	Confidence = **0.983**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Magnesium, dissolved (mg/L)
Normal Prediction Limit

Step	Equation	Description
1	$\bar{X}$ = **sum[X] / N** = **284.75 / 18** = **15.819**	Compute upgradient mean.
2	S = ((**sum[X^2] - sum[X]^2/N**) / (**N**-1))$^{1/2}$ = ((**4593.613 - 81082.563/18**) / (**18**-1))$^{1/2}$ = **2.288**	Compute upgradient sd.
3	alpha = min[(1-.95$^{1/K}$)$^{1/2}$ or .01] = min[(1-.95$^{1/140}$)$^{1/2}$ or .01] = **0.01**	Adjusted per comparison false positive rate. Pass initial or 1 resample.
4	PL = $\bar{X}$ + **tS**(1+1/**N**)$^{1/2}$ = **15.819** + (**2.565*****2.288**)(1+1/**18**)$^{1/2}$ = **21.851**	One-sided normal prediction limit (t is Student's t on N-1 degrees of freedom and 1-alpha confidence level).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Manganese, dissolved (mn) (mg/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = max(X) = **0.014**	Compute nonparametric prediction limit as largest background measurement.
2	Confidence = **0.983**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Nickel, dissolved (ni) (mg/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = median(X) = **0.005**	Compute nonparametric prediction limit as median reporting limit in background.
2	Confidence = **0.983**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Nitrate-n (no3) (mg/L)
Normal Prediction Limit

Step	Equation	Description
1	$\bar{X}$ = **sum[X] / N** = **28.516 / 15** = **1.901**	Compute upgradient mean.
2	S = ((**sum[X^2] - sum[X]^2/N**) / (**N-1**))$^{1/2}$ = ((**60.157 - 813.162/15**) / (**15-1**))$^{1/2}$ = **0.652**	Compute upgradient sd.
3	alpha = min[(1-.95$^{1/K}$)$^{1/2}$ or .01] = min[(1-.95$^{1/140}$)$^{1/2}$ or .01] = **0.01**	Adjusted per comparison false positive rate. Pass initial or 1 resample.
4	PL = $\bar{X}$ + **tS**(1+1/**N**)$^{1/2}$ = **1.901** + (**2.622*****0.652**)(1+1/**15**)$^{1/2}$ = **3.666**	One-sided normal prediction limit (t is Student's t on N-1 degrees of freedom and 1-alpha confidence level).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
pH (std units)
Normal Prediction Limit

Step	Equation	Description
1	$\bar{X}$ = **sum[X] / N** = **155.52 / 21** = **7.406**	Compute upgradient mean.
2	S = ((**sum[X^2] - sum[X]^2/N**) / (**N**-1))$^{1/2}$ = ((**1153.112 - 24186.47/21**) / (**21**-1))$^{1/2}$ = **0.262**	Compute upgradient sd.
3	alpha = min[(1-.95$^{1/K}$)$^{1/2}$ or .01] = min[(1-.95$^{1/140}$)$^{1/2}$ or .01] = **0.01**	Adjusted per comparison false positive rate. Pass initial or 1 resample. Two-sided probability.
4	PL = $\bar{X}$ ± **tS**(1+1/**N**)$^{1/2}$ = **7.406** ± (**2.844*0.262**)(1+1/**21**)$^{1/2}$ = **6.642, 8.169**	Two-sided normal prediction limit (t is Student's t on N-1 degrees of freedom and 1-alpha confidence level).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Potassium, dissolved (mg/L)
Normal Prediction Limit

Step	Equation	Description
1	$\bar{X}$ = **sum[X] / N** = **50.595 / 18** = **2.811**	Compute upgradient mean.
2	S = ((**sum[X^2] - sum[X]^2/N**) / (**N**-1))$^{1/2}$ = ((**144.135 - 2559.854/18**) / (**18**-1))$^{1/2}$ = **0.336**	Compute upgradient sd.
3	alpha = min[(1-.95$^{1/K}$)$^{1/2}$ or .01] = min[(1-.95$^{1/140}$)$^{1/2}$ or .01] = **0.01**	Adjusted per comparison false positive rate. Pass initial or 1 resample.
4	PL = $\bar{X}$ + **t**S(1+1/**N**)$^{1/2}$ = **2.811** + (**2.565*****0.336**)(1+1/**18**)$^{1/2}$ = **3.697**	One-sided normal prediction limit (t is Student's t on N-1 degrees of freedom and 1-alpha confidence level).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Selenium, dissolved (se) (mg/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = median(X) = **0.001**	Compute nonparametric prediction limit as median reporting limit in background.
2	Confidence = **0.983**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Silver, dissolved (ag) (mg/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = max(X) = **2.00×10^{-4}**	Compute nonparametric prediction limit as largest background measurement.
2	Confidence = **0.983**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Sodium, dissolved (mg/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = max(X) = **13.8**	Compute nonparametric prediction limit as largest background measurement.
2	Confidence = **0.98**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Specific conductance (umhos/cm)
Normal Prediction Limit

Step	Equation	Description
1	$\bar{X}$ = **sum[X] / N** = **4910.0 / 20** = **245.5**	Compute upgradient mean.
2	S = ((**sum[X^2] - sum[X]^2/N**) / (**N**-1))$^{1/2}$ = ((**1.22x10^6 - 2.41x10^7/20**) / (**20**-1))$^{1/2}$ = **28.924**	Compute upgradient sd.
3	alpha = min[(1-.95$^{1/K}$)$^{1/2}$ or .01] = min[(1-.95$^{1/140}$)$^{1/2}$ or .01] = **0.01**	Adjusted per comparison false positive rate. Pass initial or 1 resample.
4	PL = $\bar{X}$ + **tS**(1+1/**N**)$^{1/2}$ = **245.5** + (**2.538*28.924**)(1+1/**20**)$^{1/2}$ = **320.735**	One-sided normal prediction limit (t is Student's t on N-1 degrees of freedom and 1-alpha confidence level).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Sulfate, total (so4) (mg/L)
Normal Prediction Limit

Step	Equation	Description
1	$\bar{X}$ = **sum[X] / N** = **274.5 / 21** = **13.071**	Compute upgradient mean.
2	S = ((**sum[X^2] - sum[X]^2/N**) / (**N**-1))$^{1/2}$ = ((**3632.25 - 75350.25/21**) / (**21**-1))$^{1/2}$ = **1.486**	Compute upgradient sd.
3	alpha = min[(1-.95$^{1/K}$)$^{1/2}$ or .01] = min[(1-.95$^{1/140}$)$^{1/2}$ or .01] = **0.01**	Adjusted per comparison false positive rate. Pass initial or 1 resample.
4	PL = $\bar{X}$ + **tS**(1+1/**N**)$^{1/2}$ = **13.071** + (**2.527*****1.486**)(1+1/**21**)$^{1/2}$ = **16.914**	One-sided normal prediction limit (t is Student's t on N-1 degrees of freedom and 1-alpha confidence level).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Thallium, dissolved (mg/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = median(X) = **0.001**	Compute nonparametric prediction limit as median reporting limit in background.
2	Confidence = **0.98**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Total dissolved solids (mg/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = max(X) = **550.0**	Compute nonparametric prediction limit as largest background measurement.
2	Confidence = **0.982**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Total organic carbon (toc) (mg/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = max(X) = **10.0**	Compute nonparametric prediction limit as largest background measurement.
2	Confidence = **0.985**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

Worksheet 1 - Upgradient vs. Downgradient Comparisons
Vanadium, dissolved (mg/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = max(X) = **0.01**	Compute nonparametric prediction limit as largest background measurement.
2	Confidence = **0.98**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

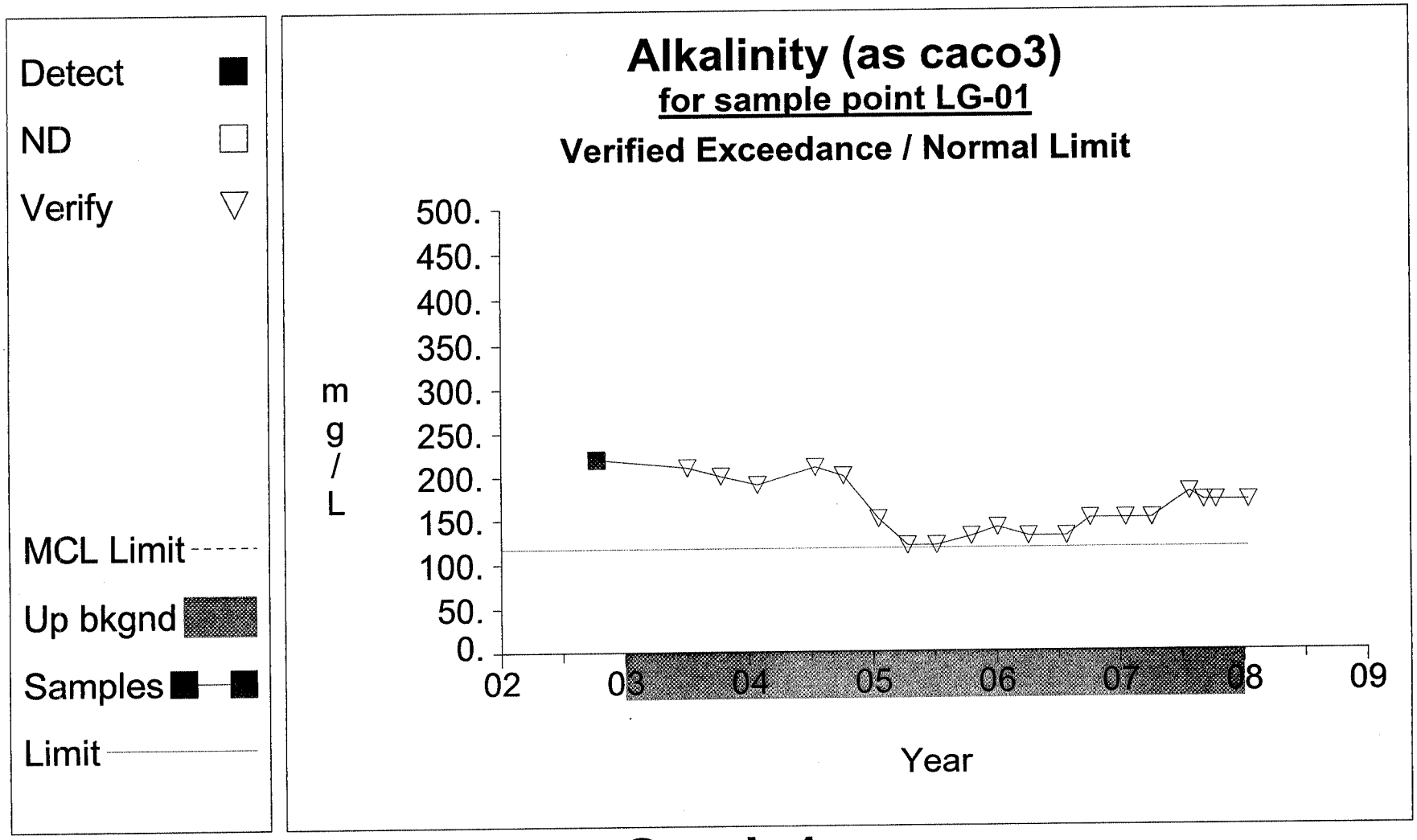
Worksheet 1 - Upgradient vs. Downgradient Comparisons
Zinc, dissolved (zn) (mg/L)
Nonparametric Prediction Limit

Step	Equation	Description
1	PL = max(X) = **0.019**	Compute nonparametric prediction limit as largest background measurement.
2	Confidence = **0.98**	Confidence level is based on N, K and resampling strategy (see Gibbons 1994).

APPENDIX H

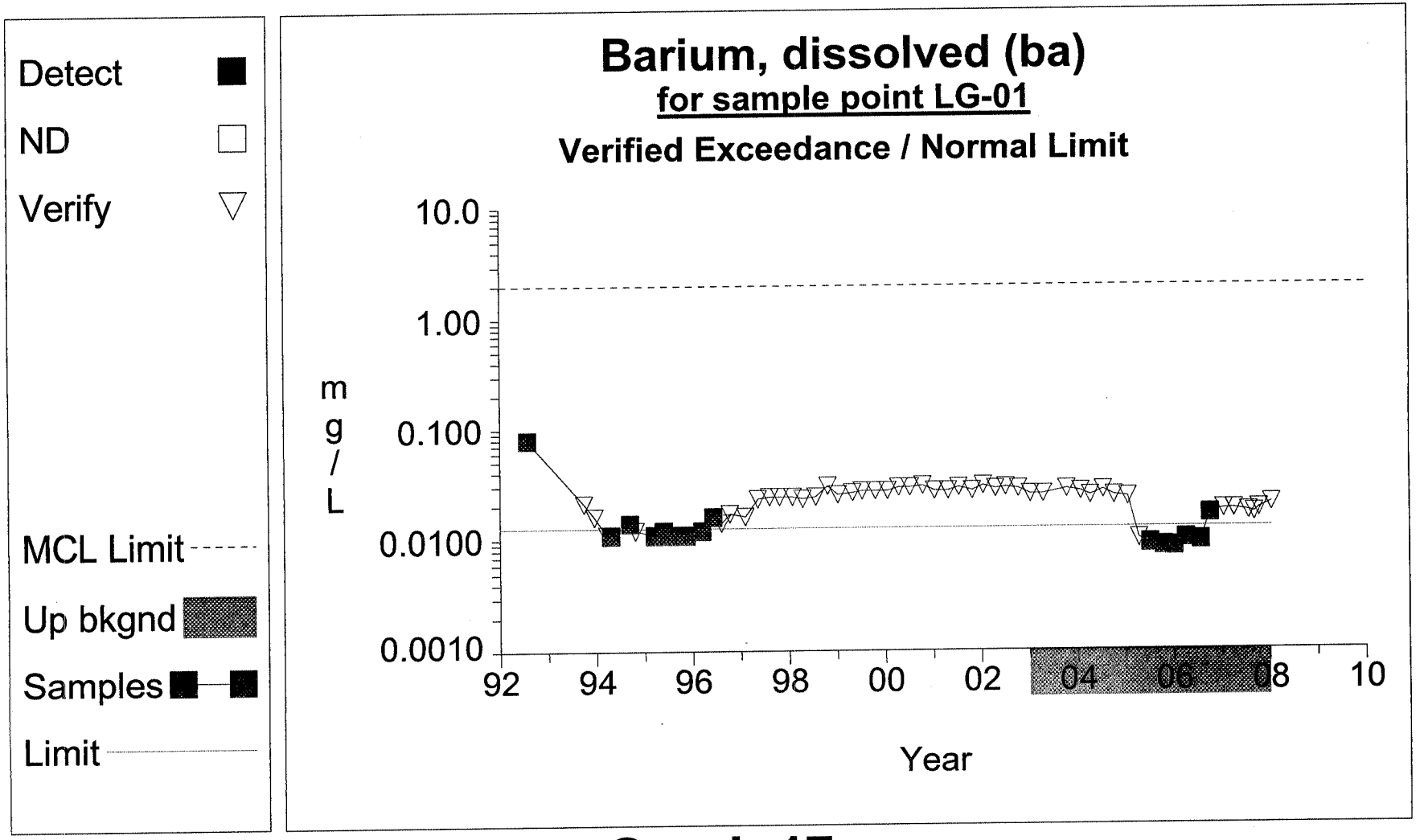
1st QUARTER

Up vs. Down Prediction Limits



Graph 1

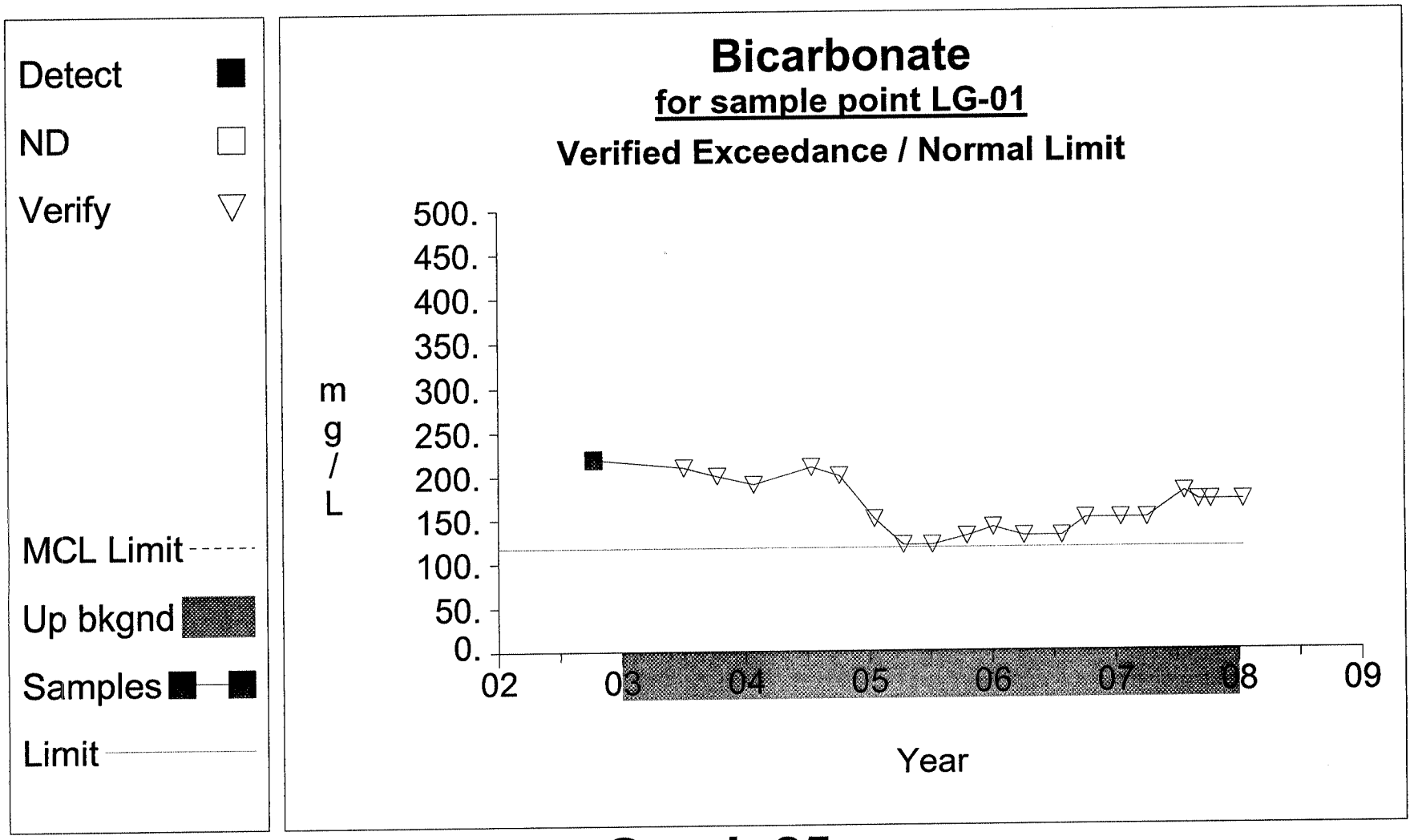
Up vs. Down Prediction Limits



Graph 17

Analysis prepared on: 1/22/2009

Up vs. Down Prediction Limits

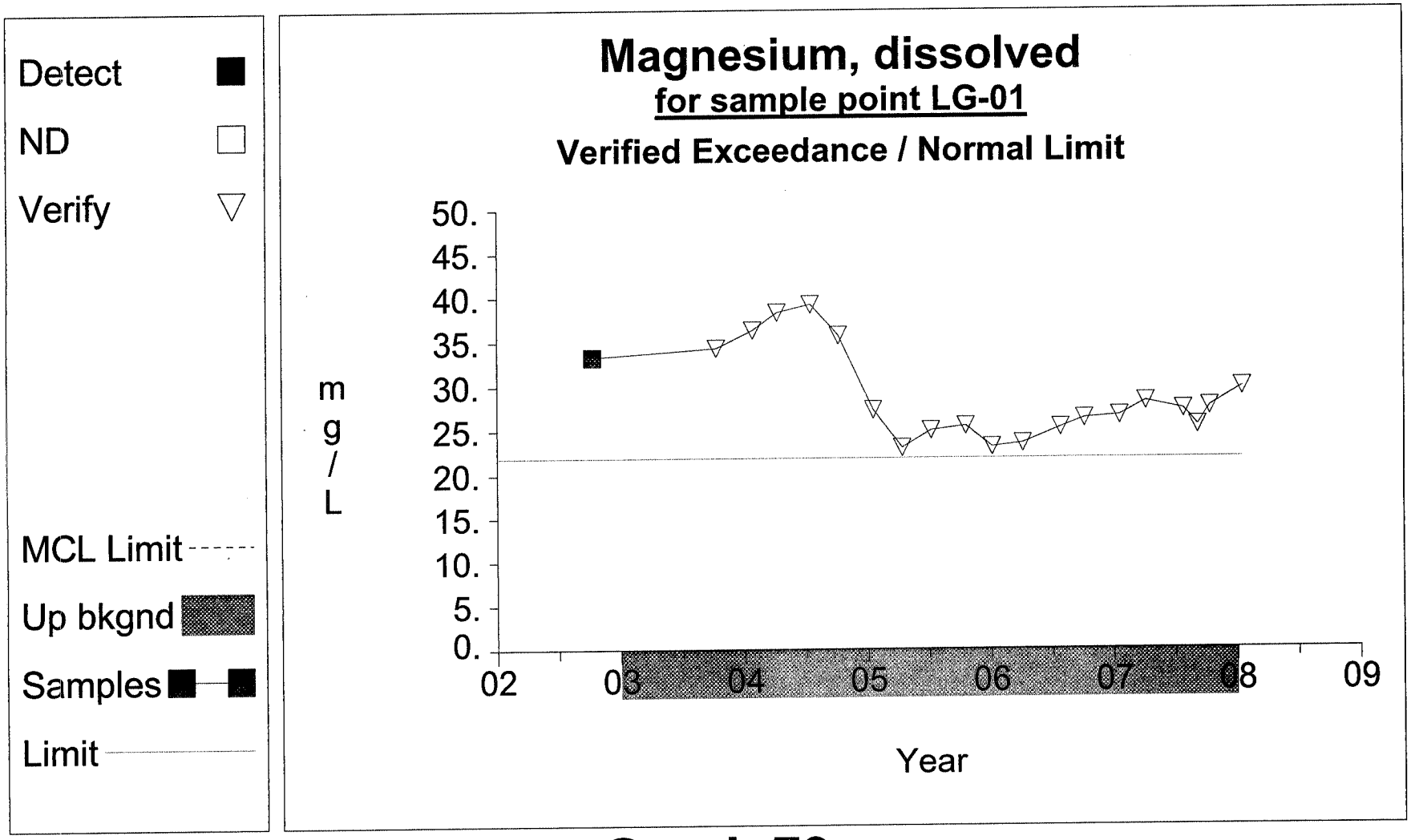


Graph 25

Prepared by: Snohomish County Solid Waste

Analysis prepared on: 1/22/2009

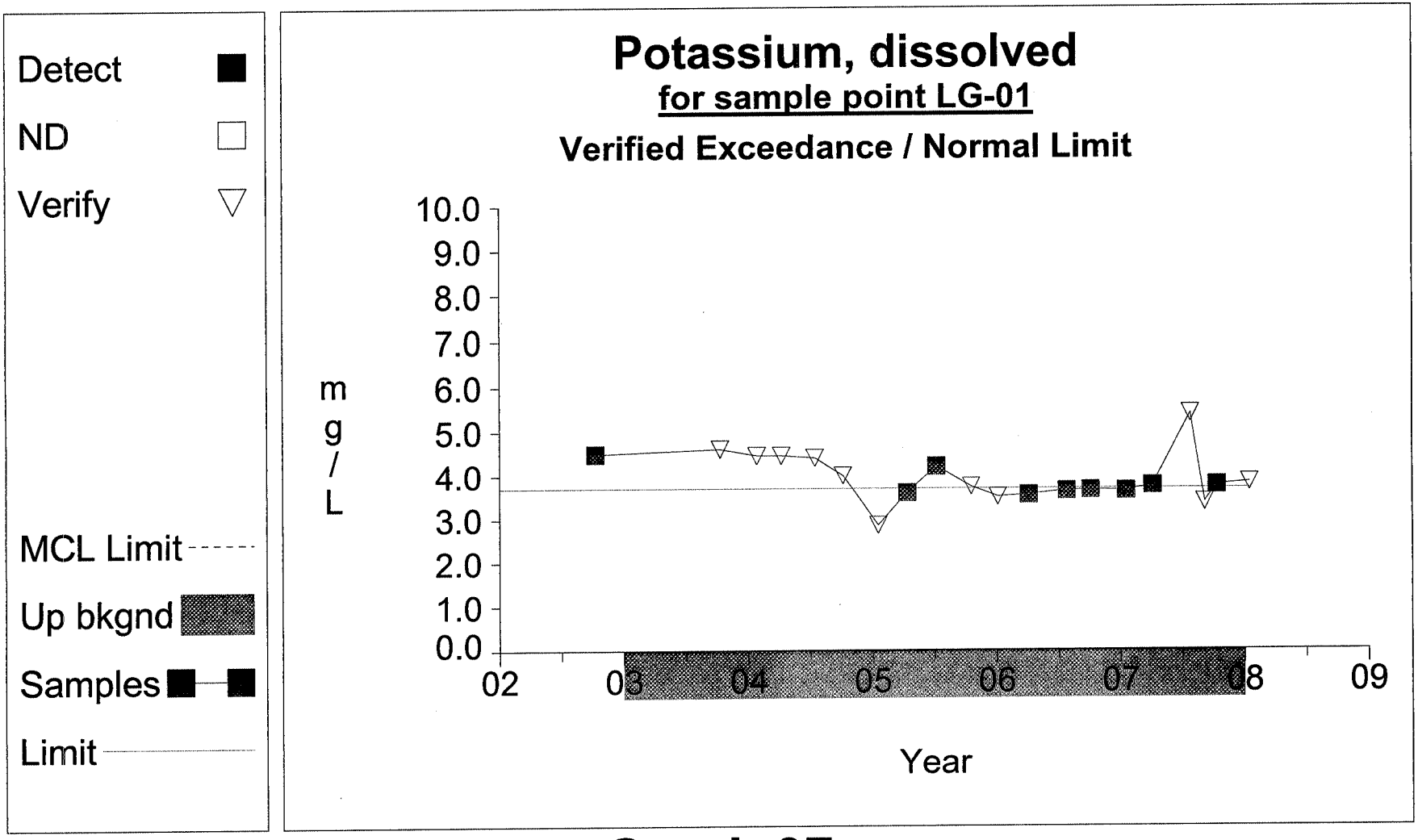
Up vs. Down Prediction Limits



Graph 73

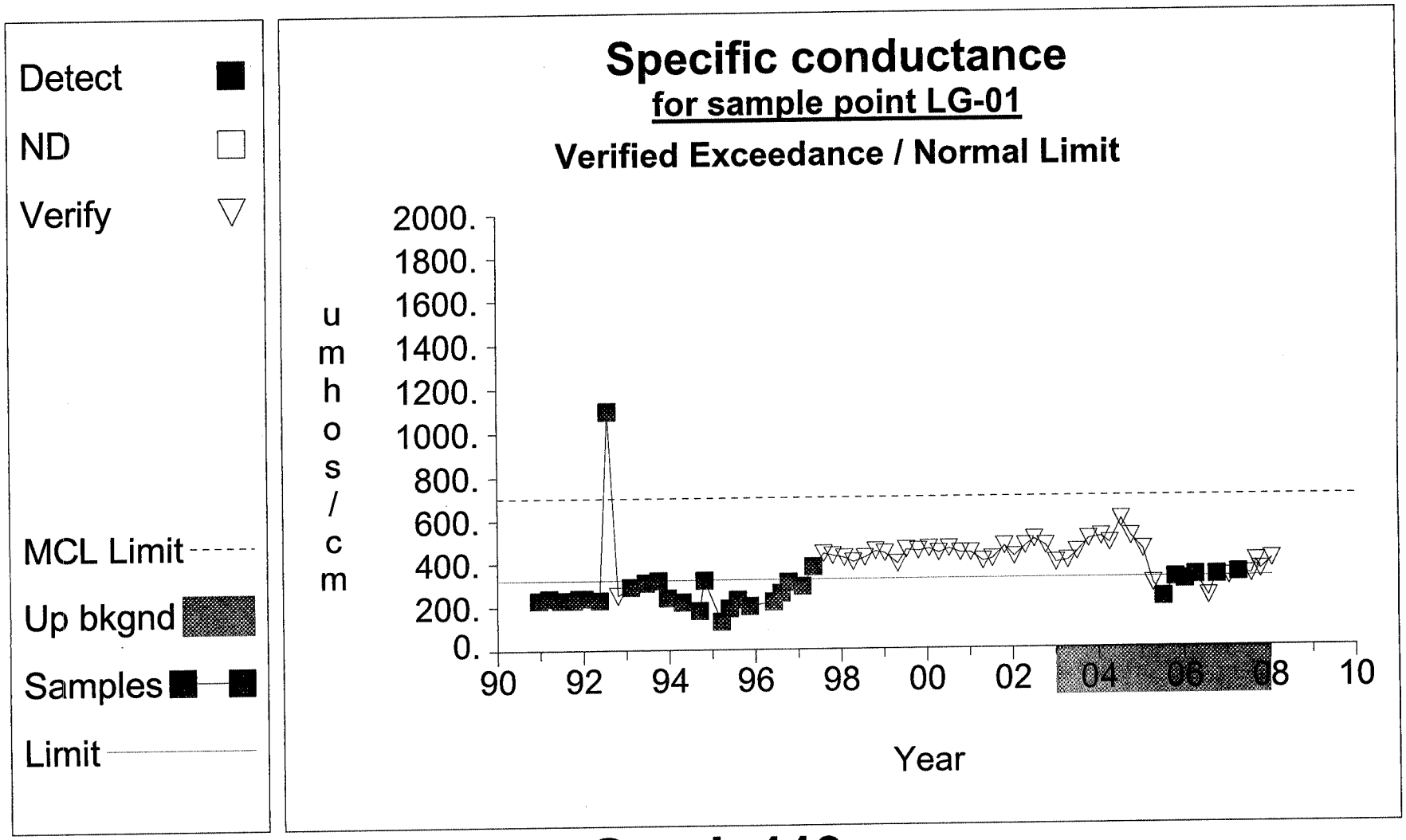
Prepared by: Snohomish County Solid Waste

Up vs. Down Prediction Limits



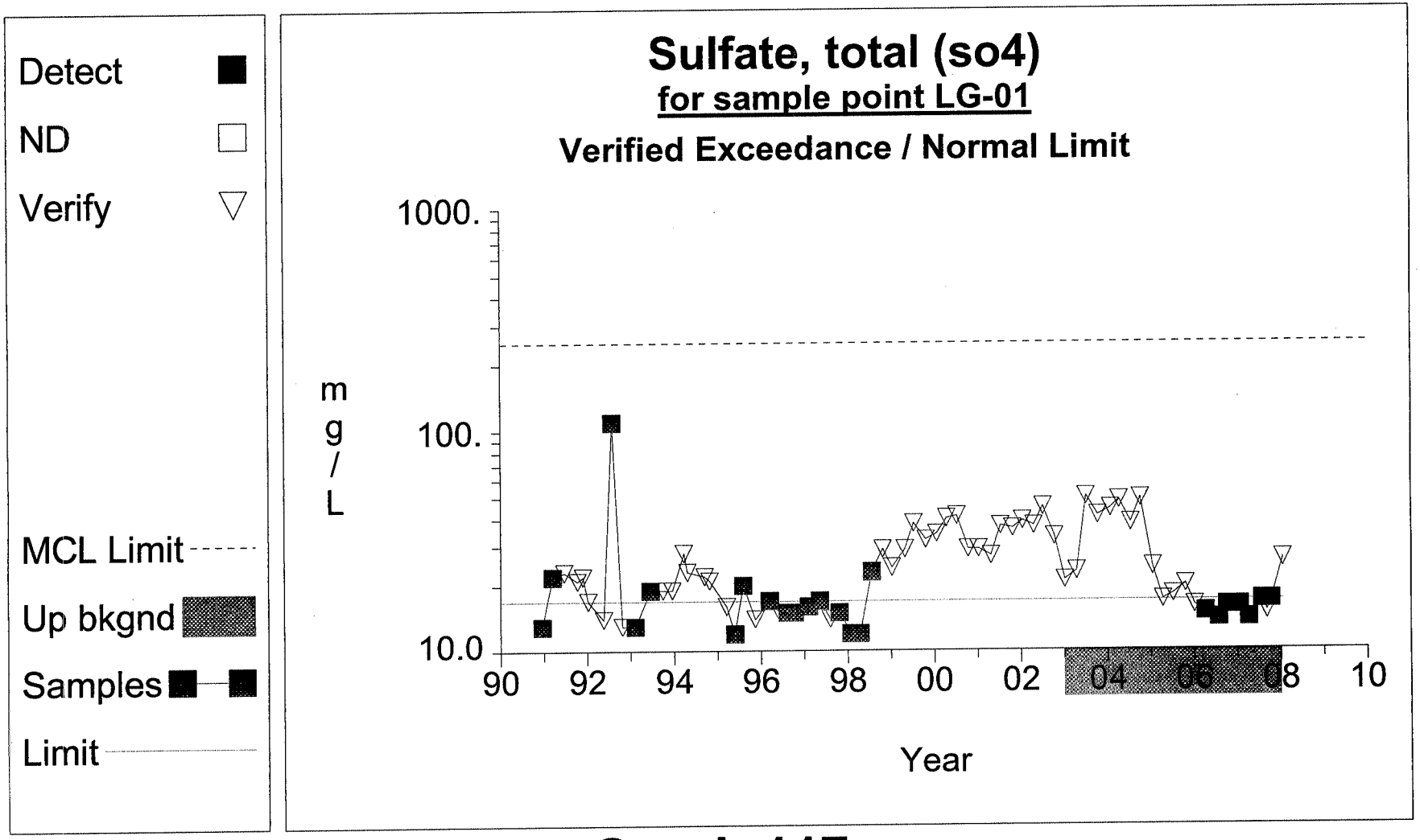
Graph 97

Up vs. Down Prediction Limits



Graph 113

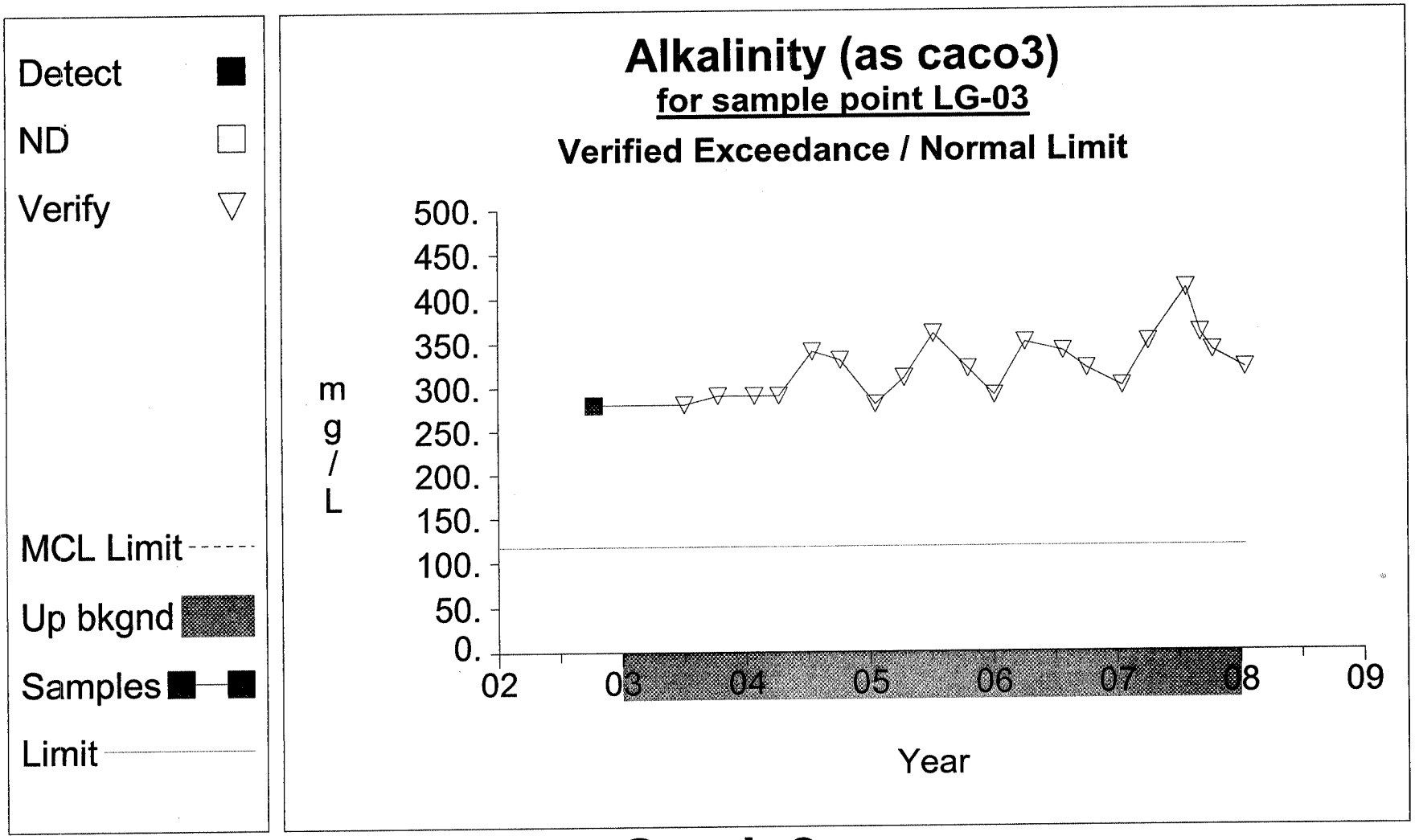
Up vs. Down Prediction Limits



Graph 117

Analysis prepared on: 1/22/2009

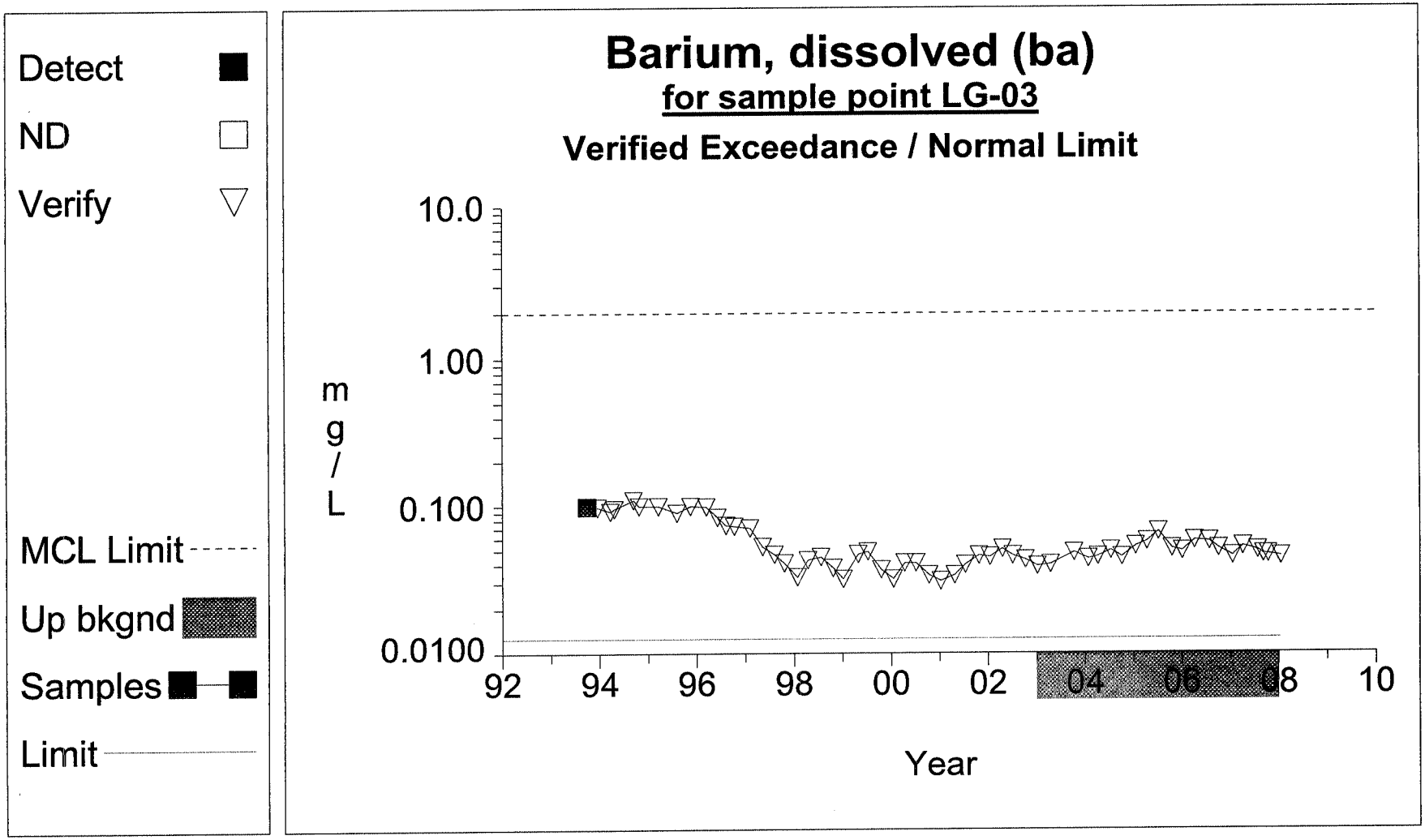
Up vs. Down Prediction Limits



Graph 2

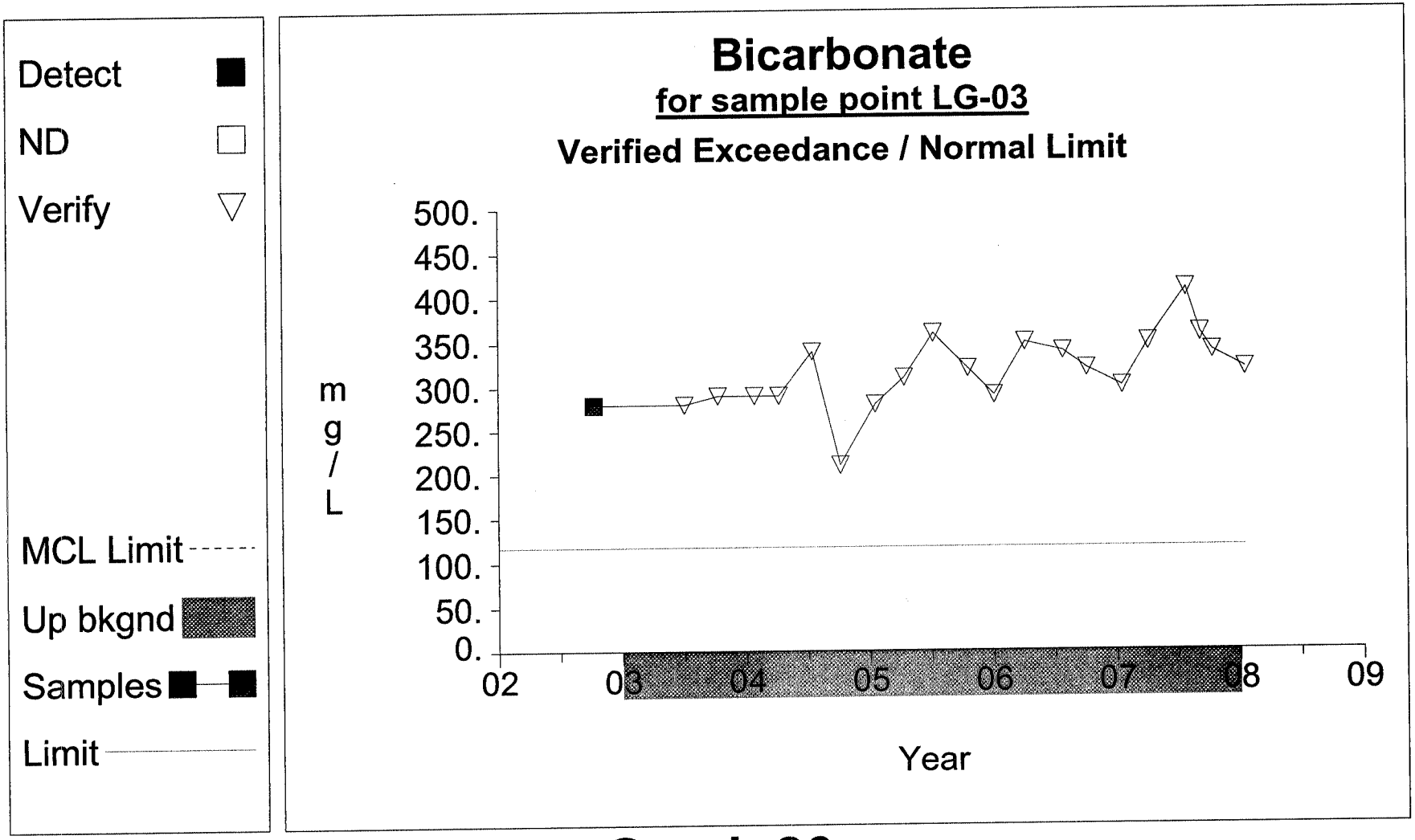
Prepared by: Snohomish County Solid Waste

Up vs. Down Prediction Limits



Graph 18

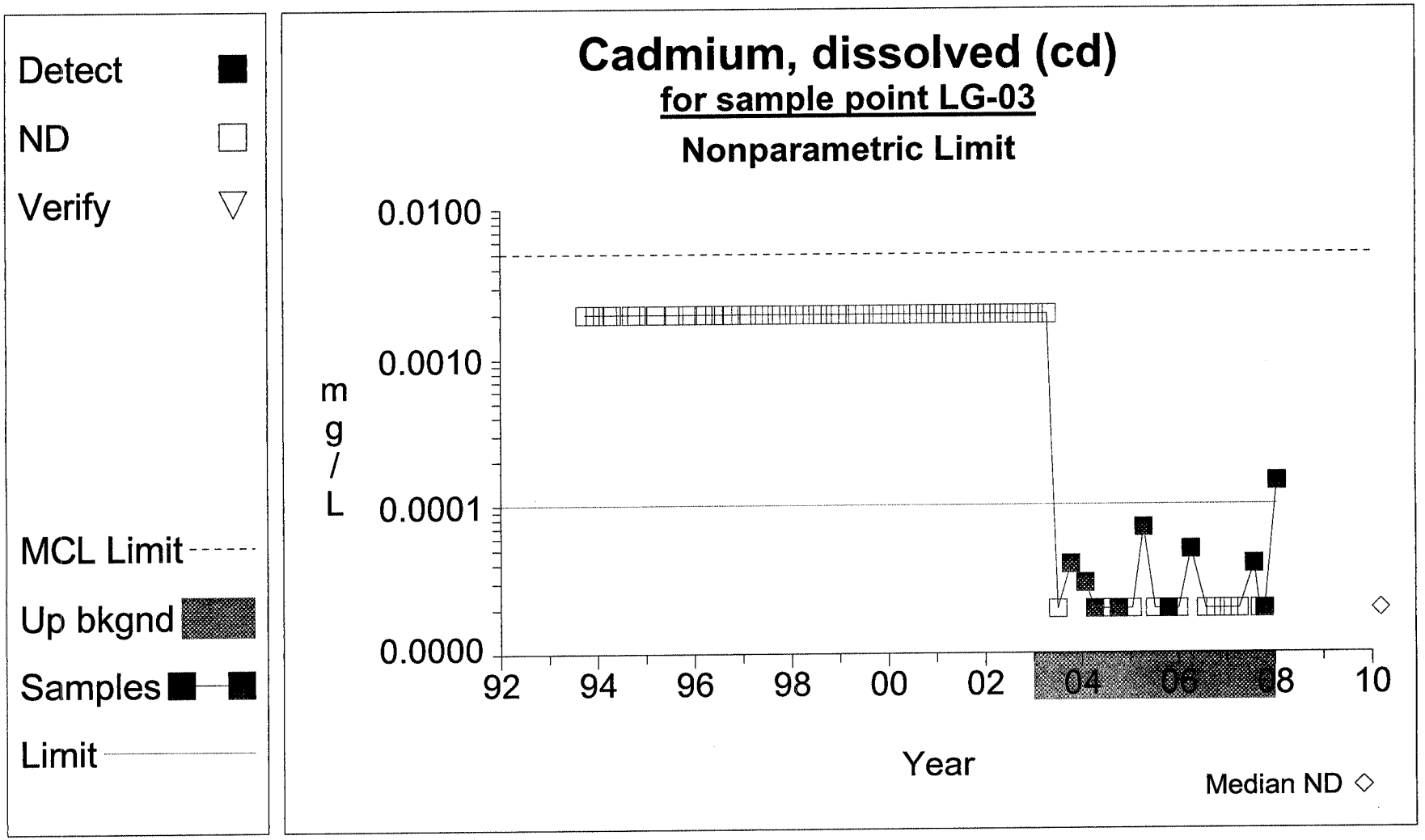
Up vs. Down Prediction Limits



Graph 26

Analysis prepared on: 1/22/2009

Up vs. Down Prediction Limits

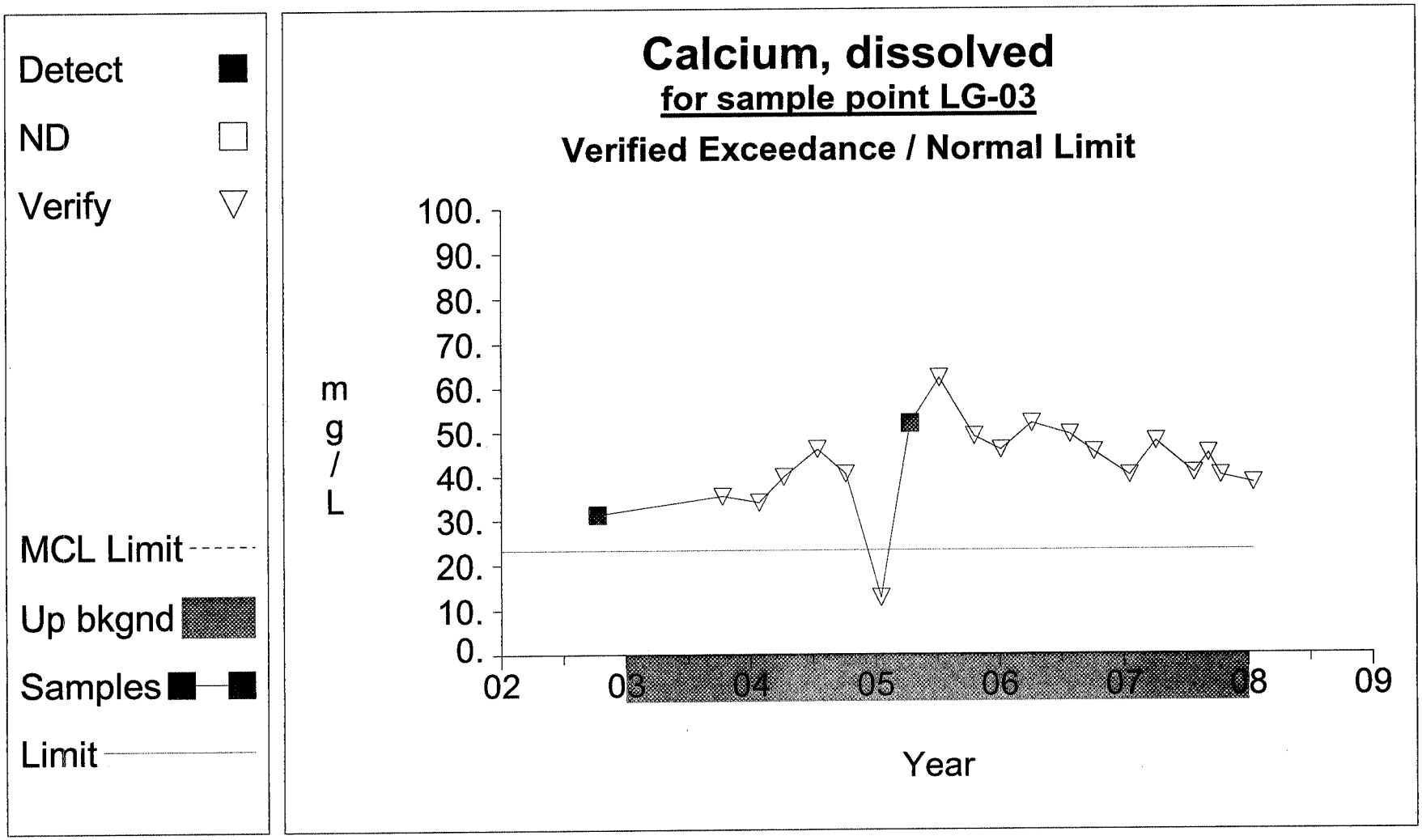


Graph 34

Prepared by: Snohomish County Solid Waste

Analysis prepared on: 1/22/2009

Up vs. Down Prediction Limits

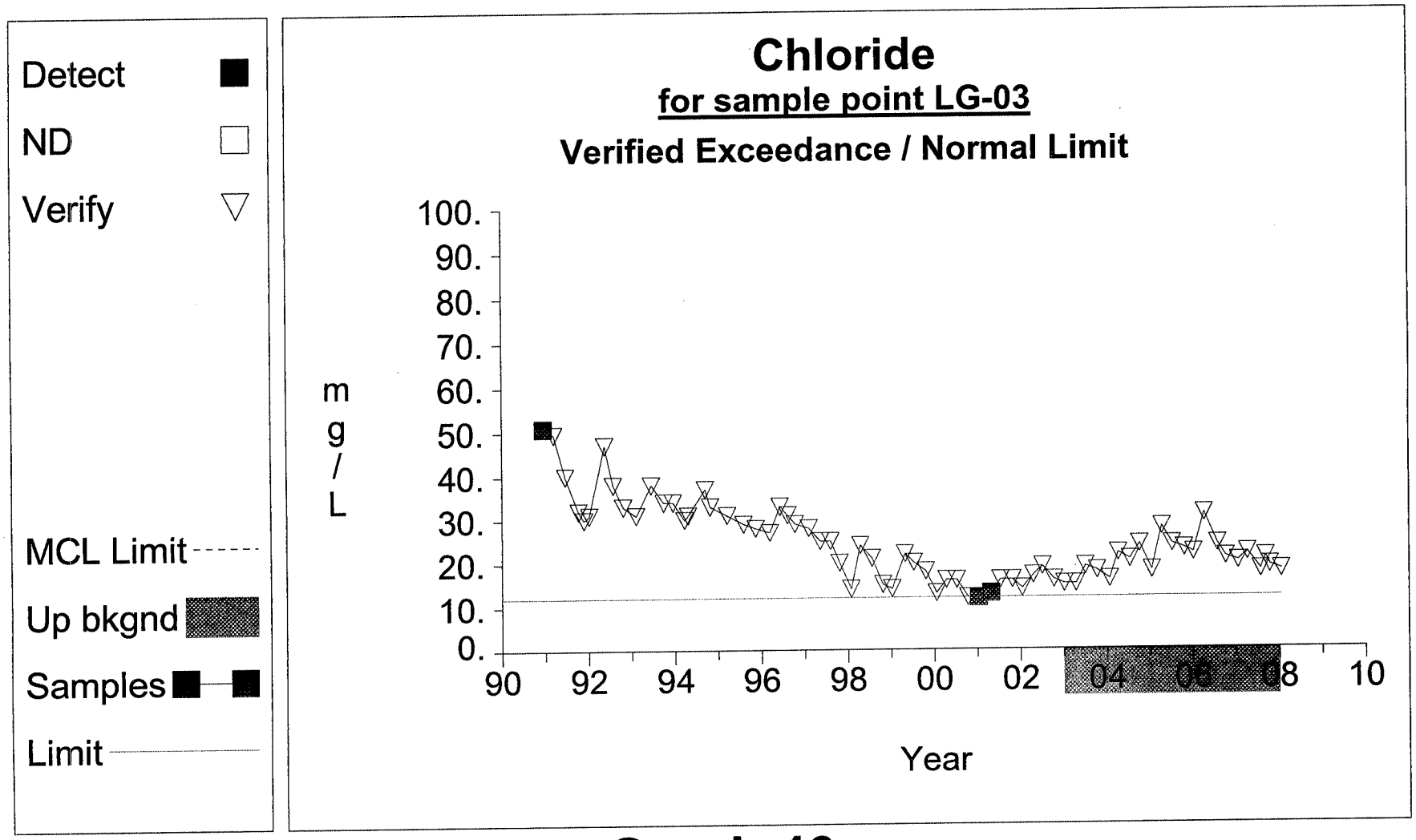


Graph 38

Prepared by: Snohomish County Solid Waste

Analysis prepared on: 1/22/2009

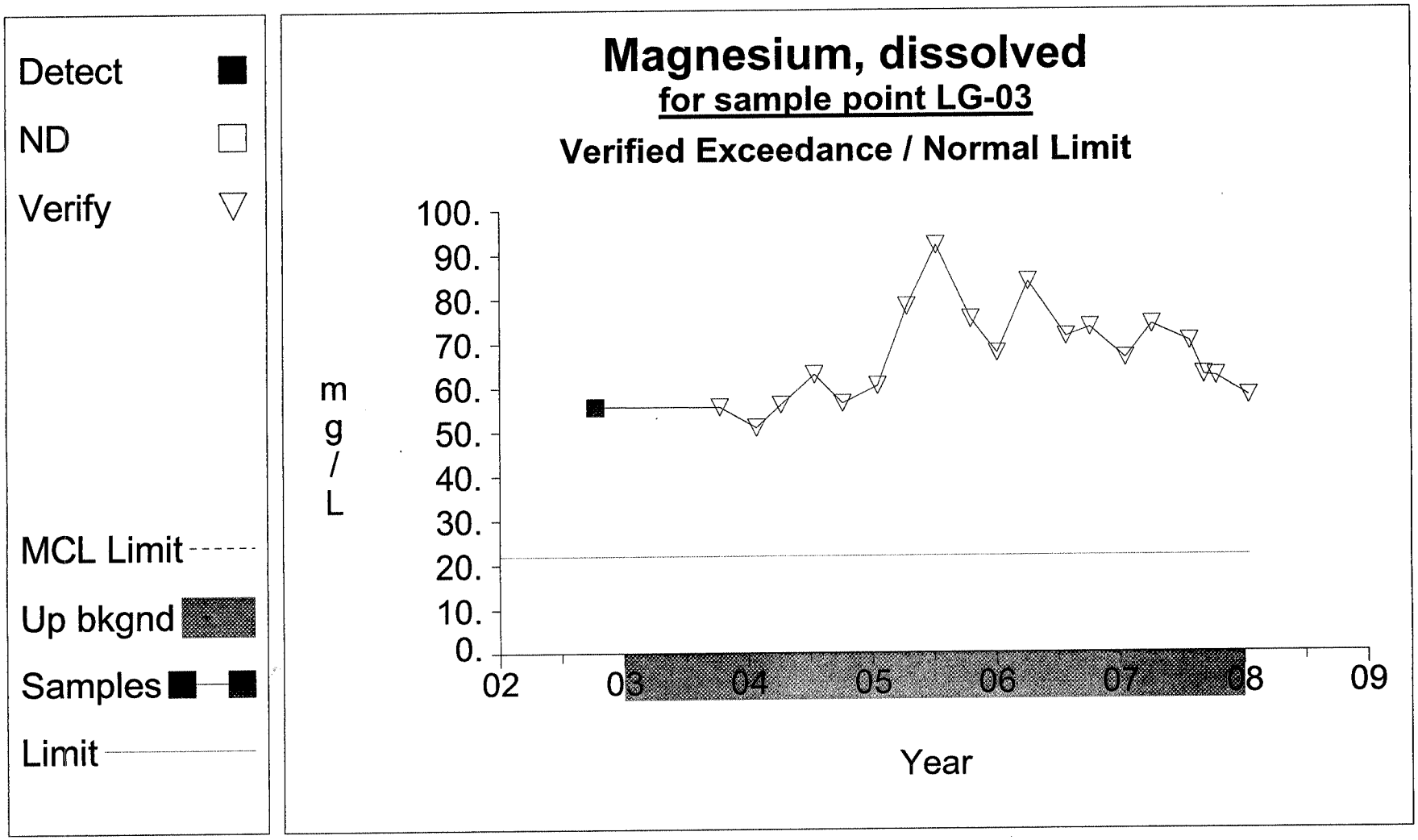
Up vs. Down Prediction Limits



Graph 46

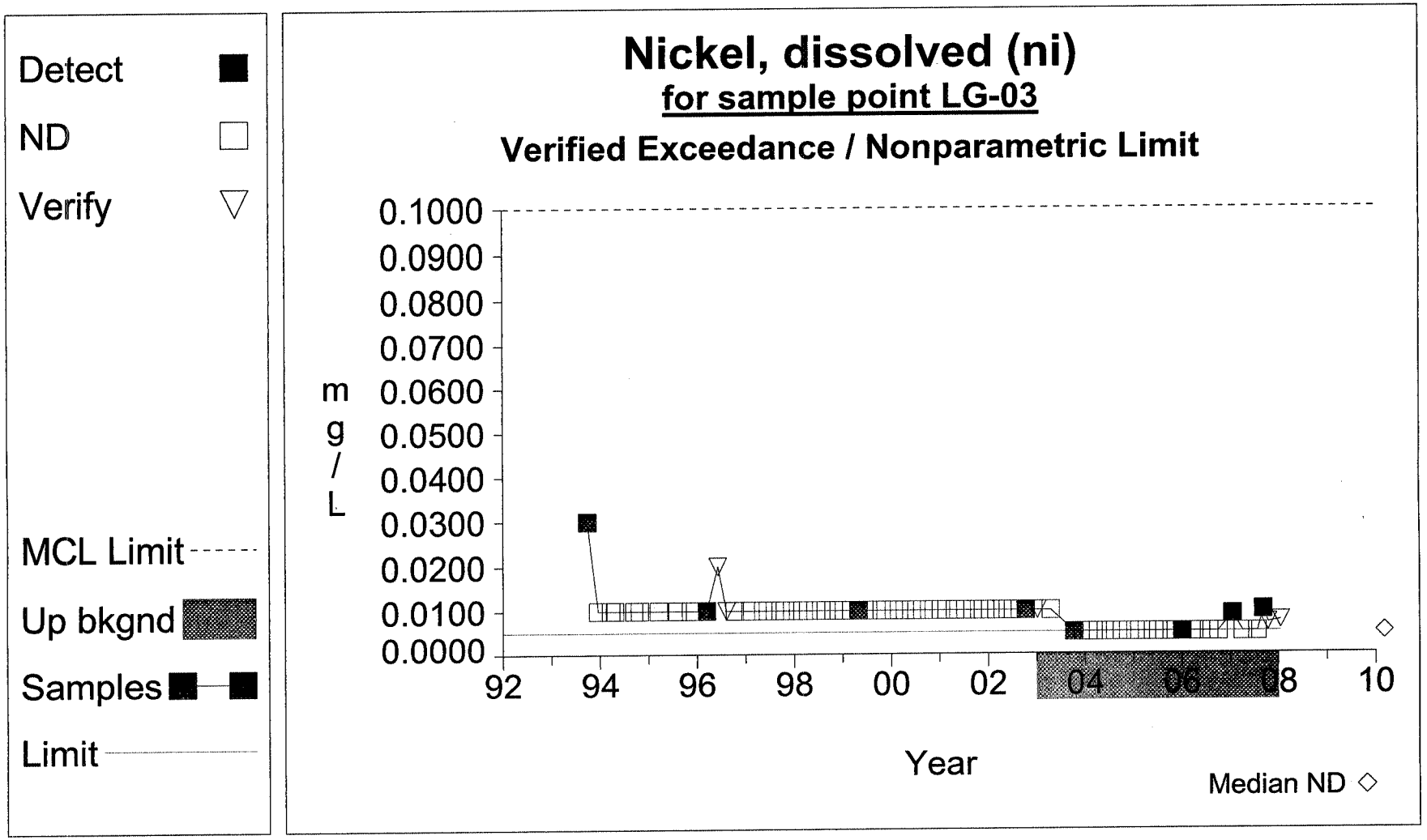
Prepared by: Snohomish County Solid Waste

Up vs. Down Prediction Limits



Graph 74

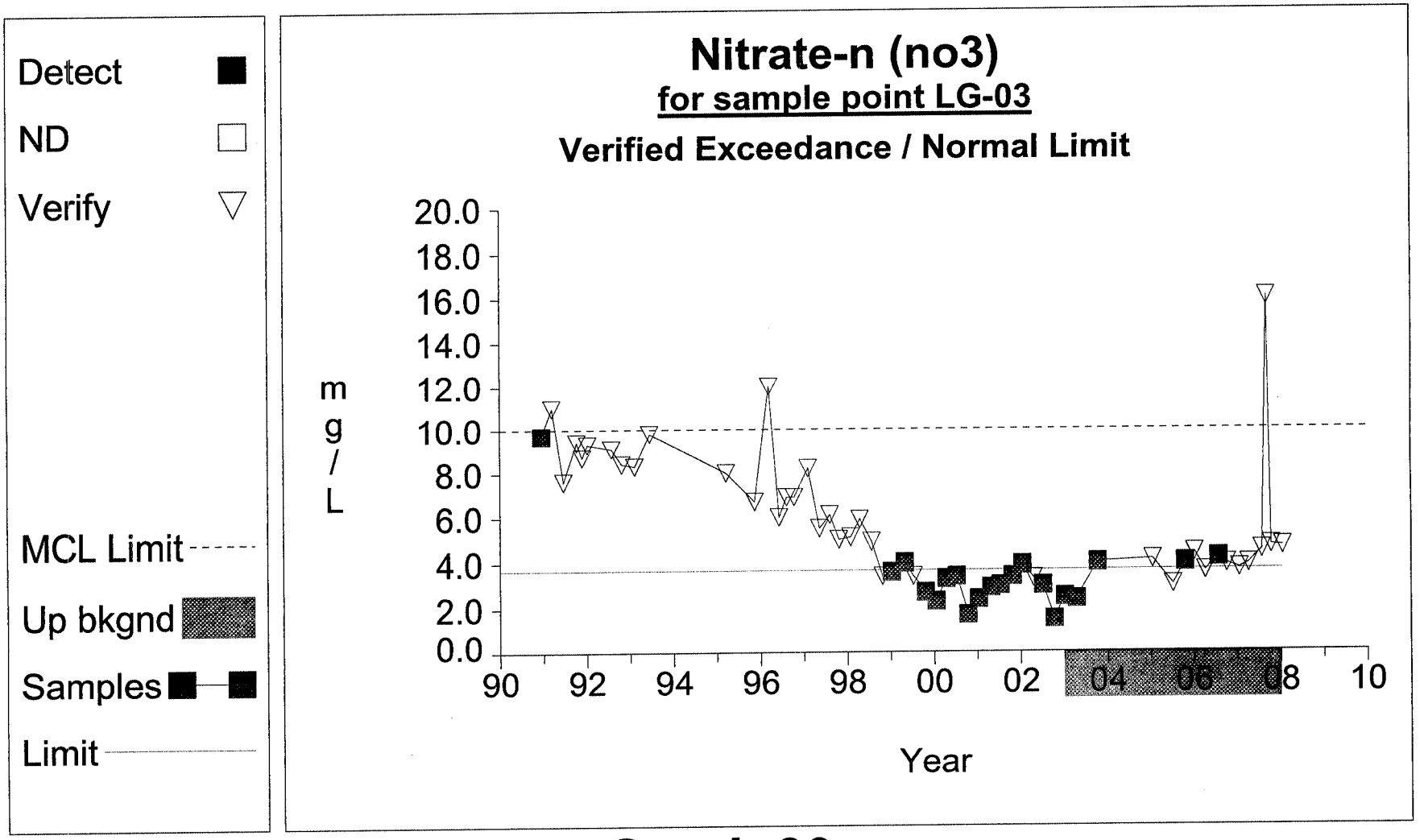
Up vs. Down Prediction Limits



Graph 86

Analysis prepared on: 1/22/2009

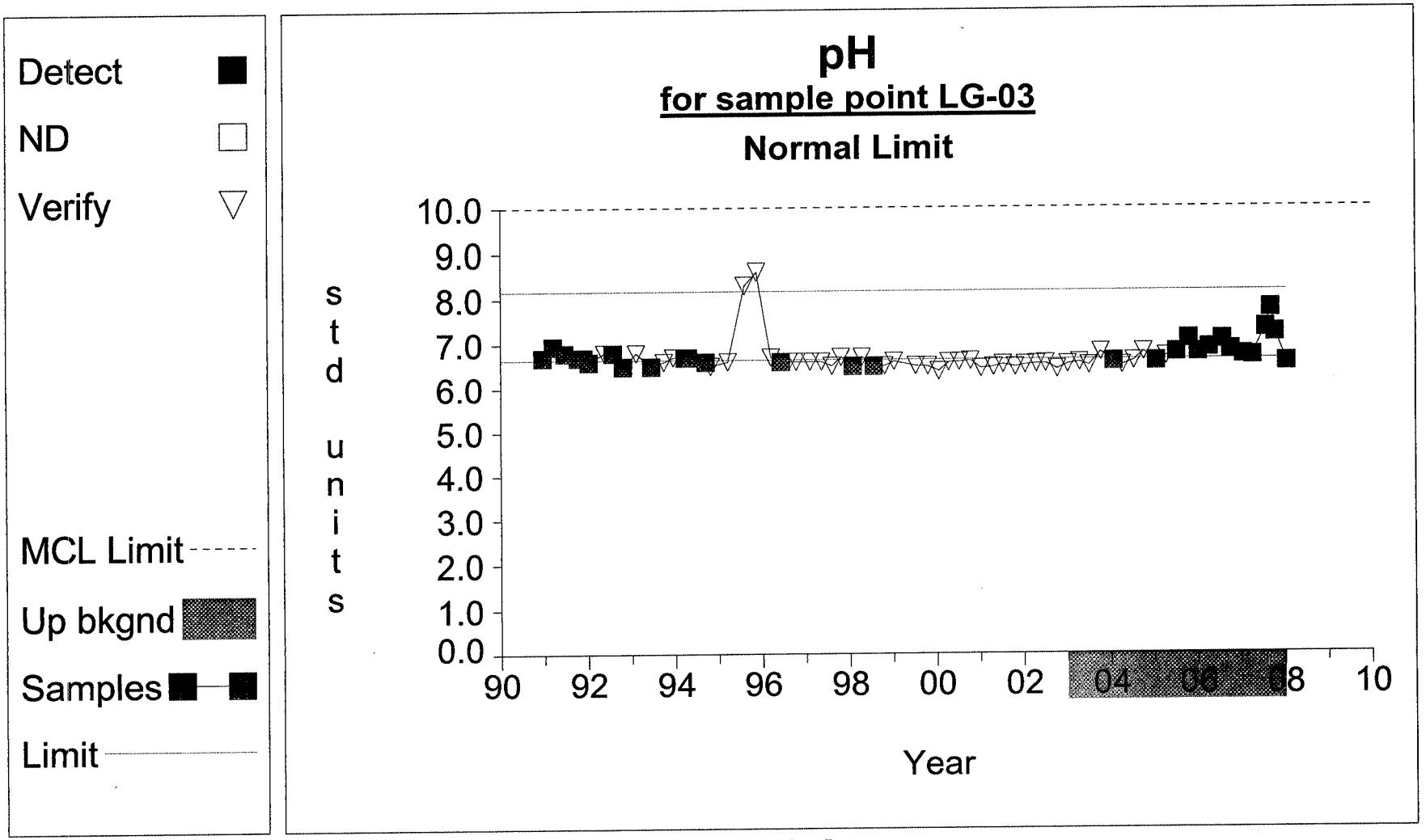
Up vs. Down Prediction Limits



Graph 90

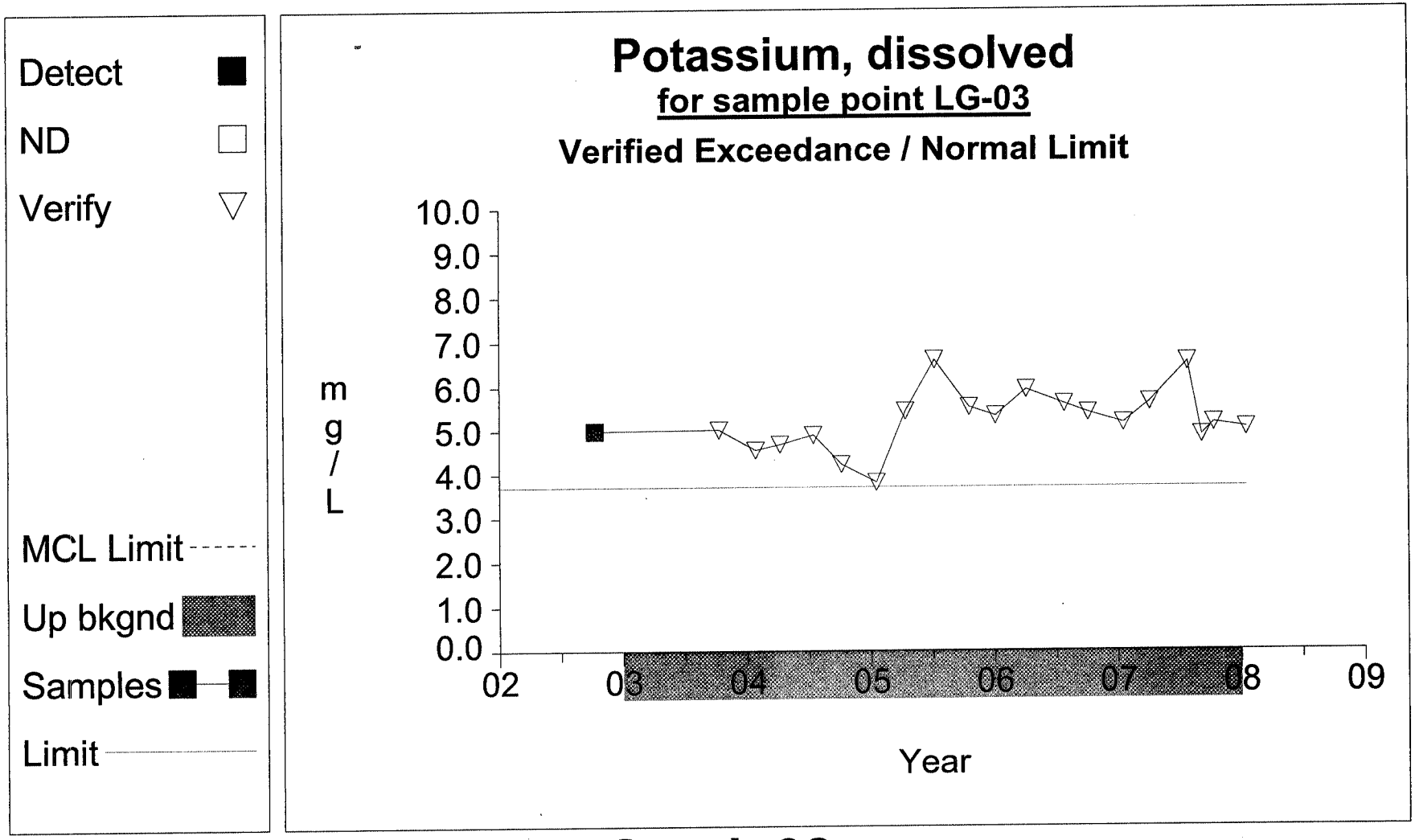
Prepared by: Snohomish County Solid Waste

Up vs. Down Prediction Limits



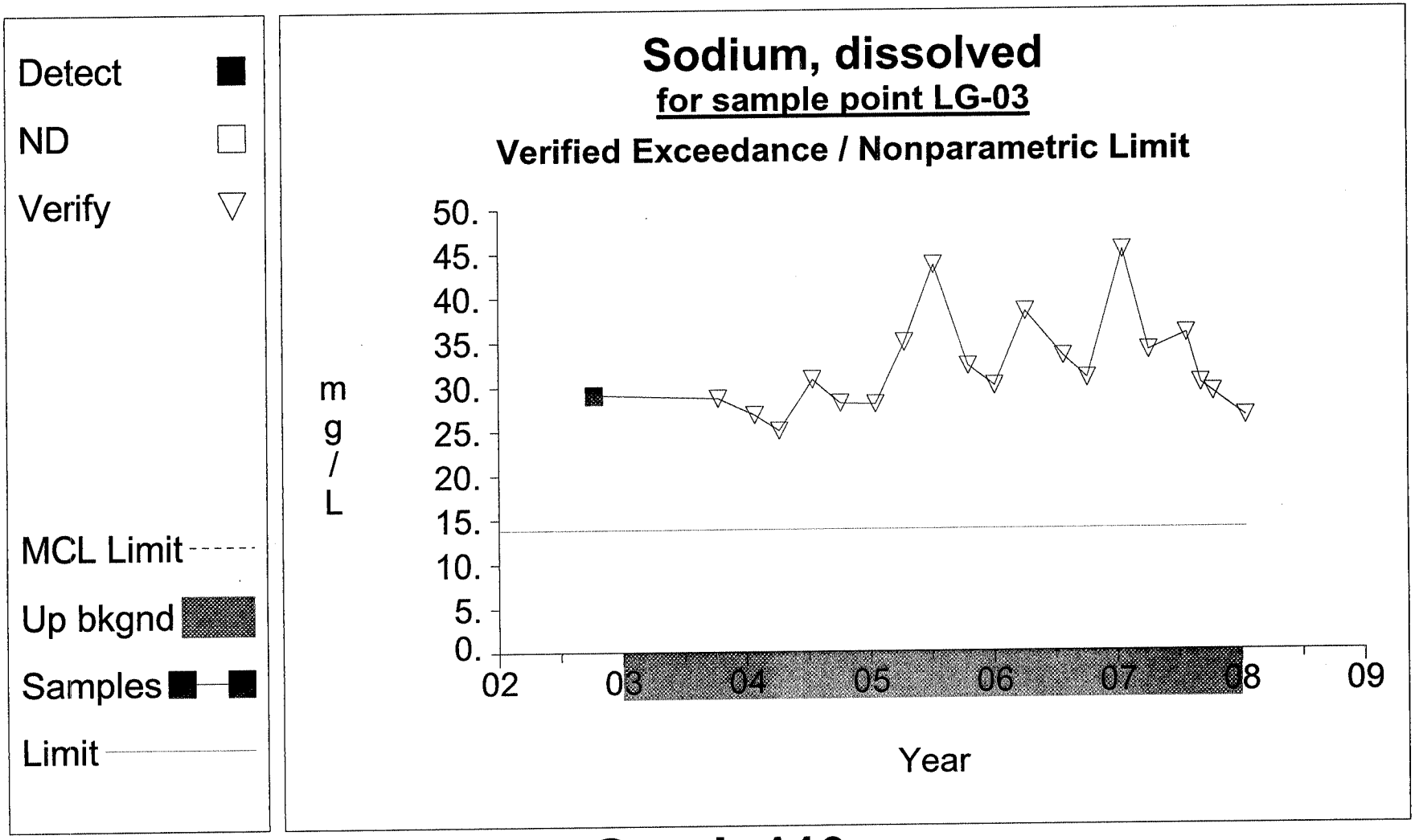
Graph 94

Up vs. Down Prediction Limits



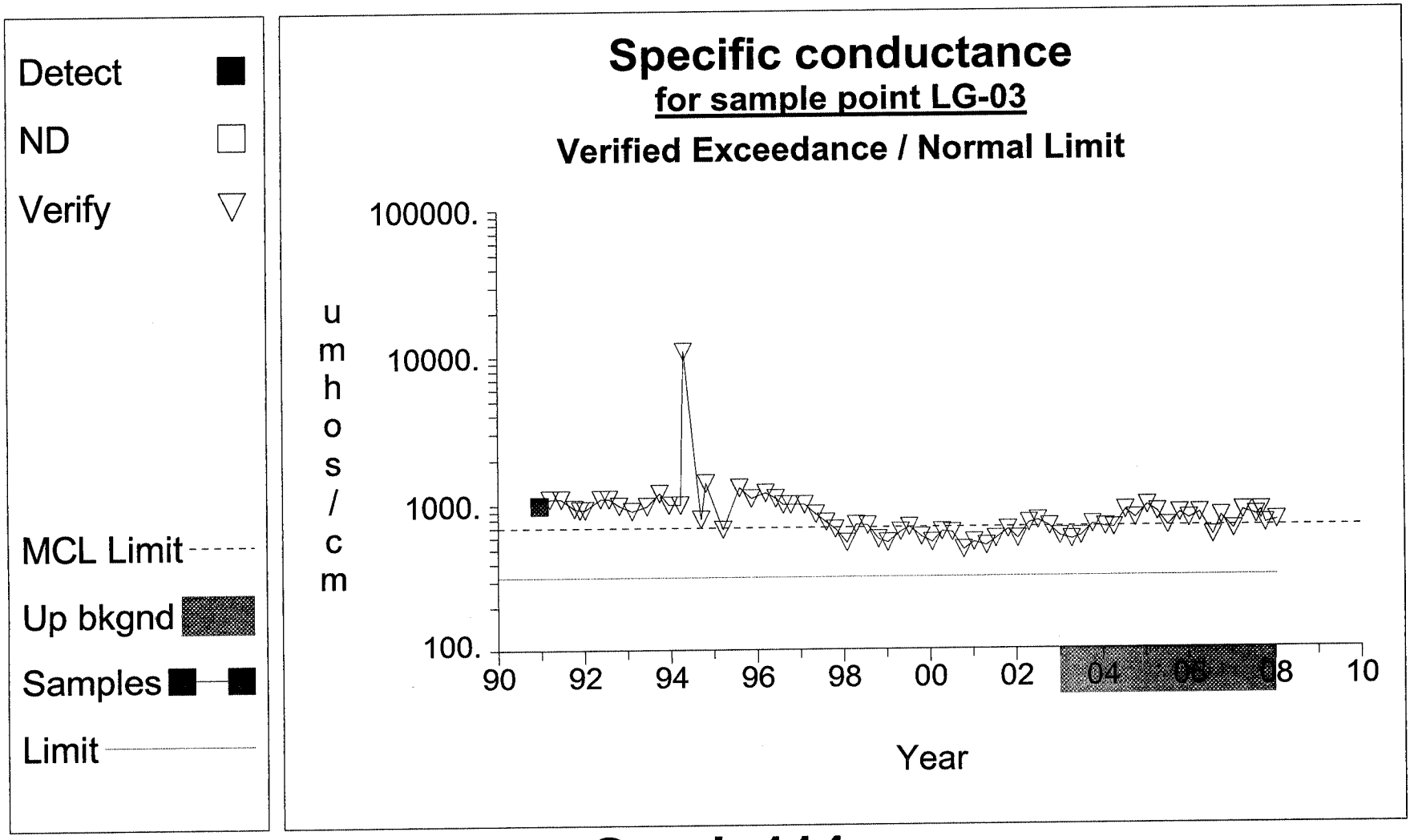
Graph 98

Up vs. Down Prediction Limits



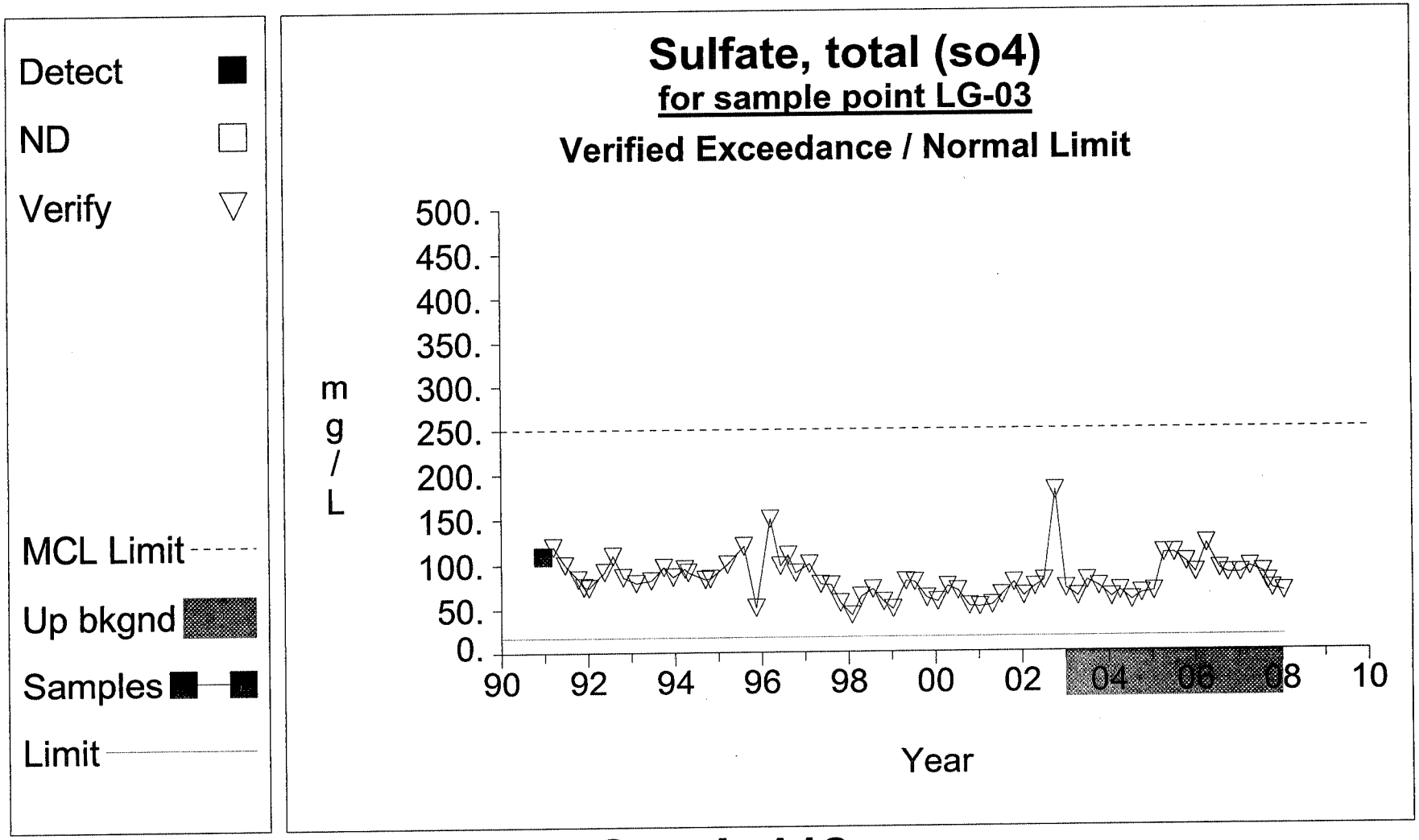
Graph 110

Up vs. Down Prediction Limits



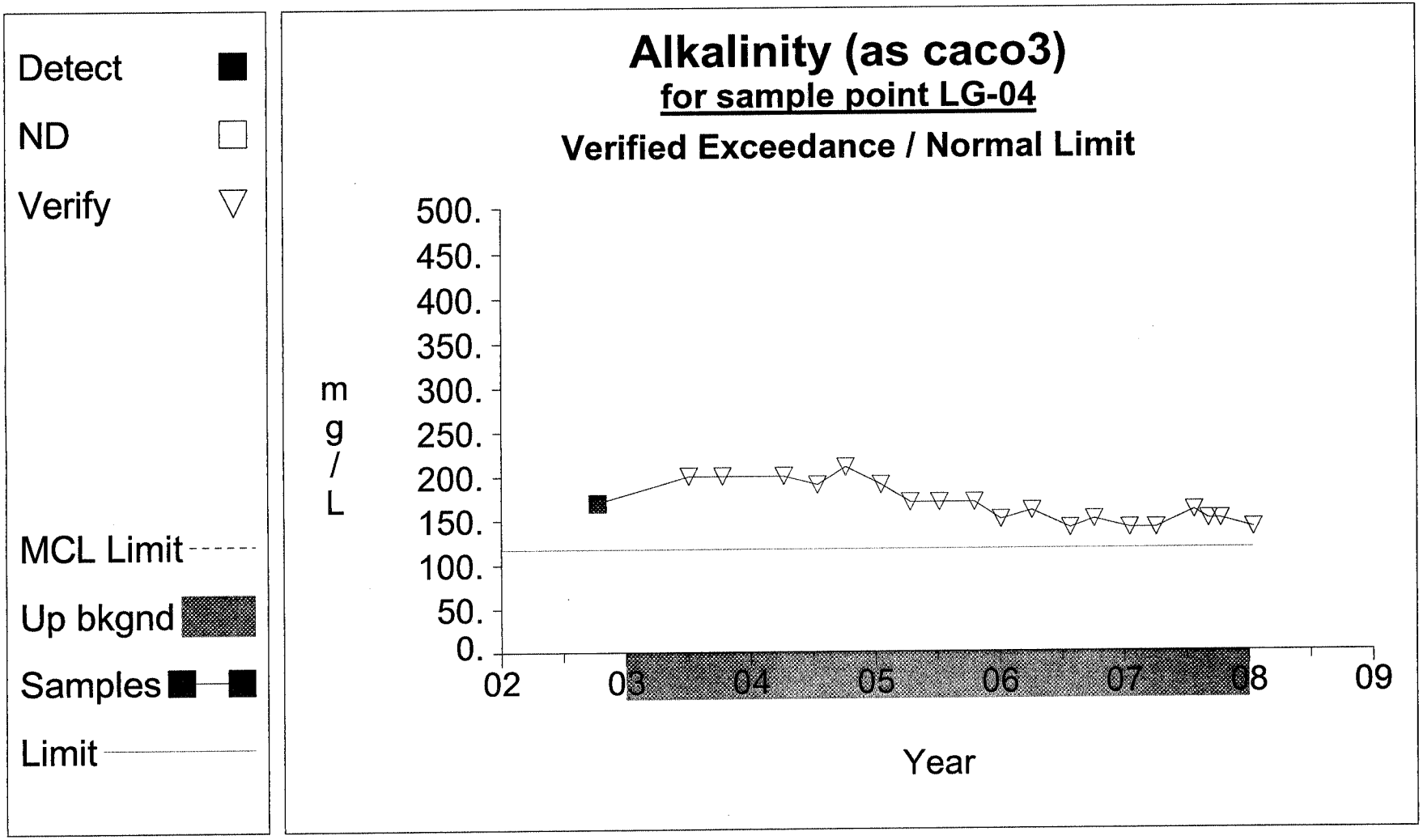
Graph 114

Up vs. Down Prediction Limits



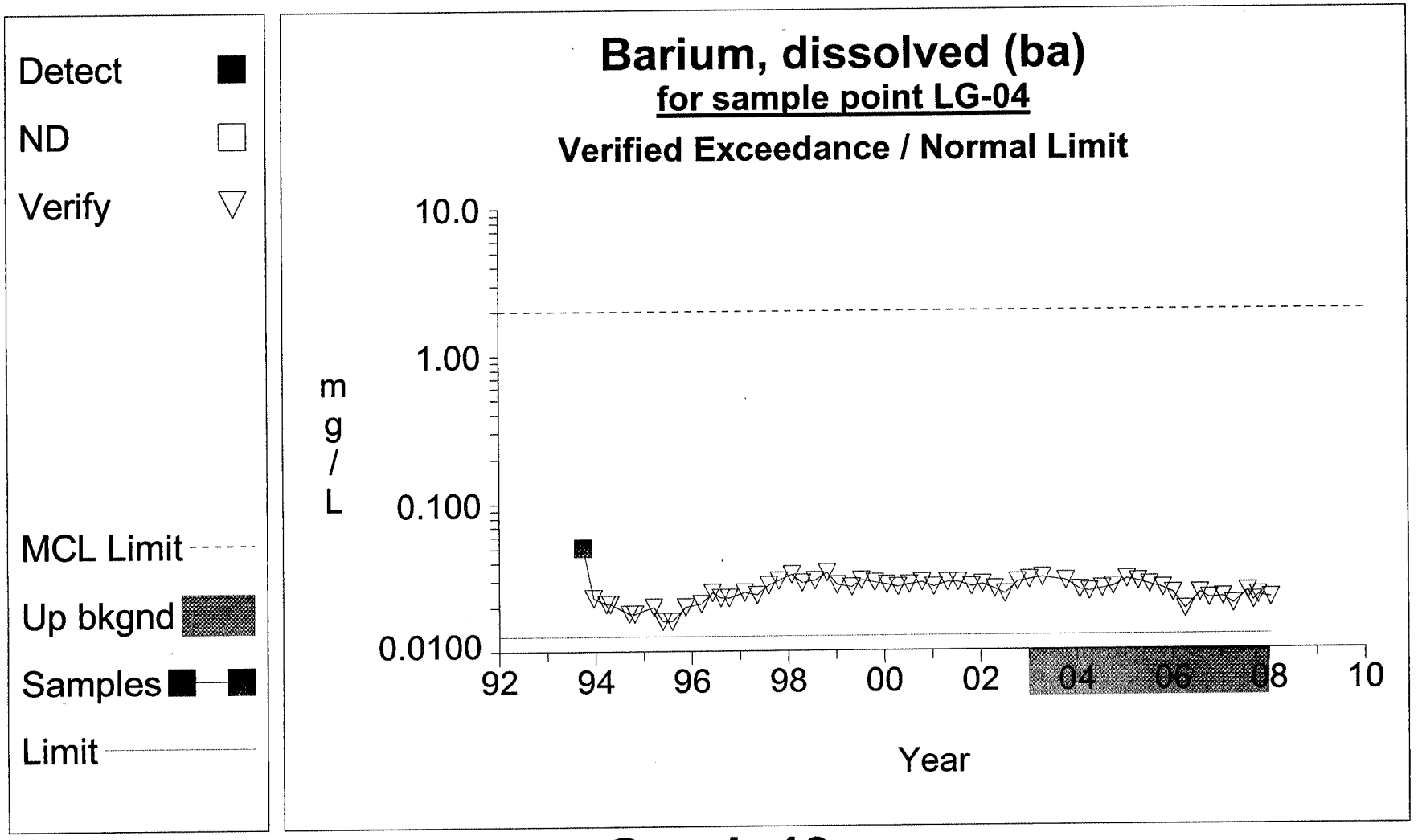
Graph 118

Up vs. Down Prediction Limits



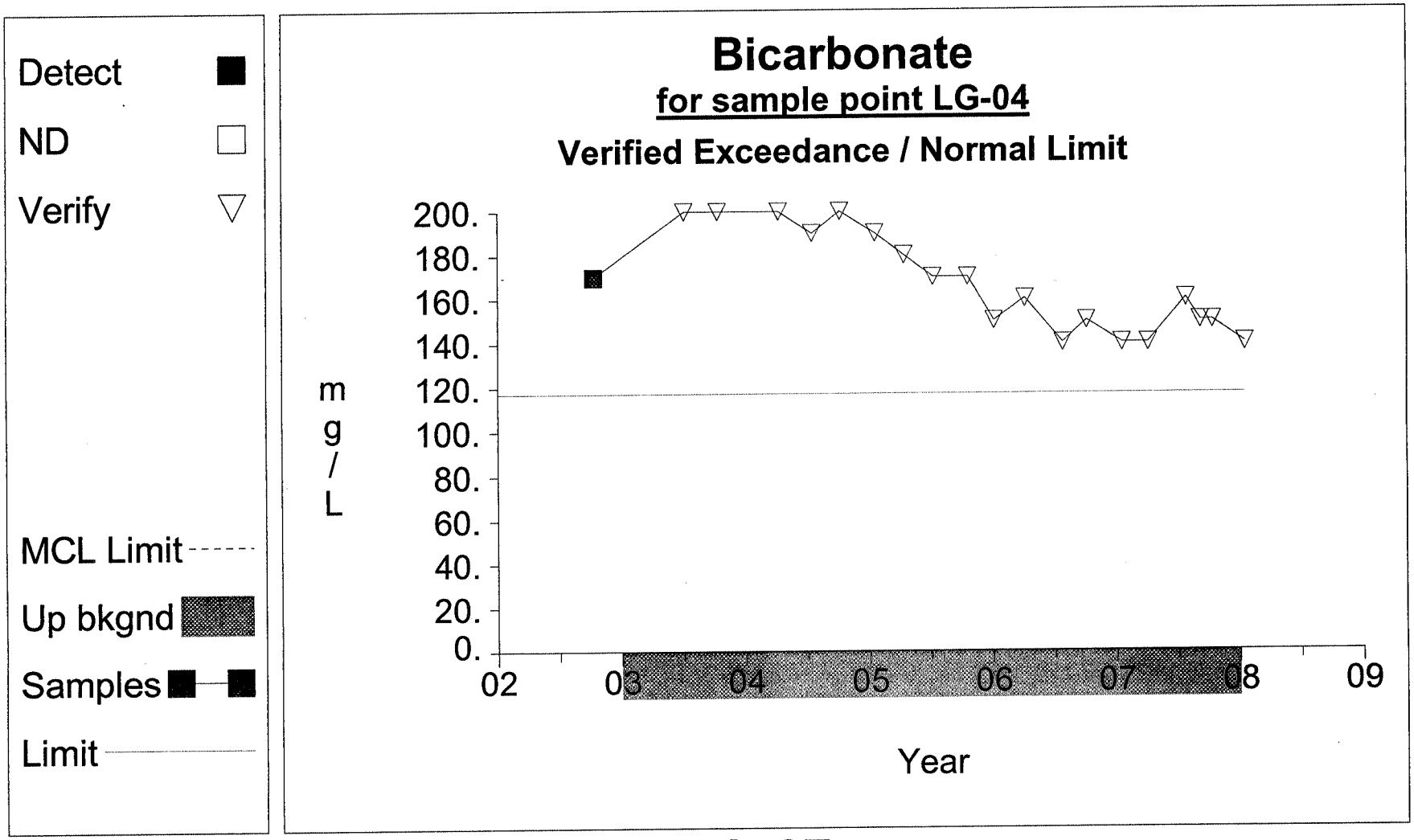
Graph 3

Up vs. Down Prediction Limits



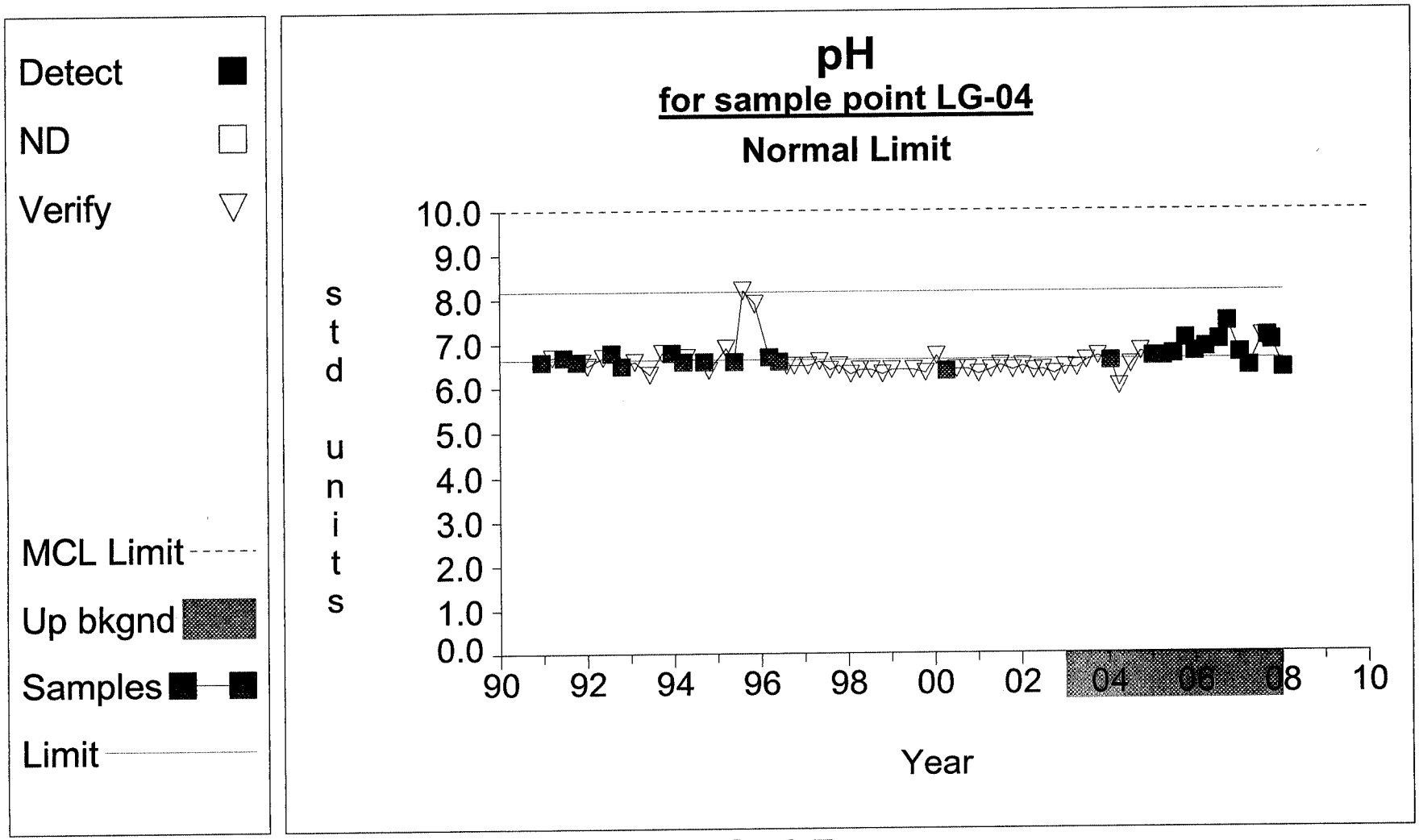
Graph 19

Up vs. Down Prediction Limits



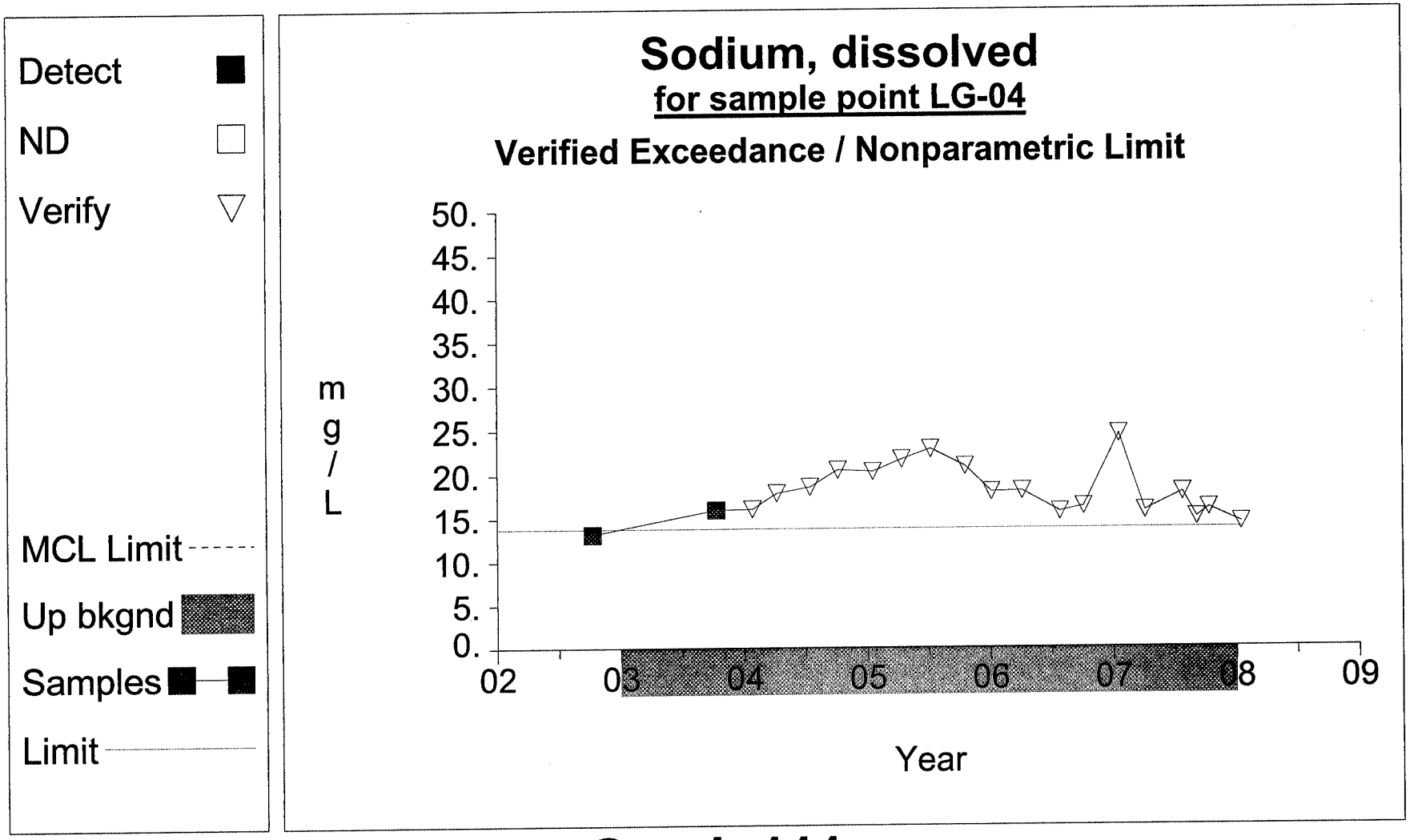
Graph 27

Up vs. Down Prediction Limits



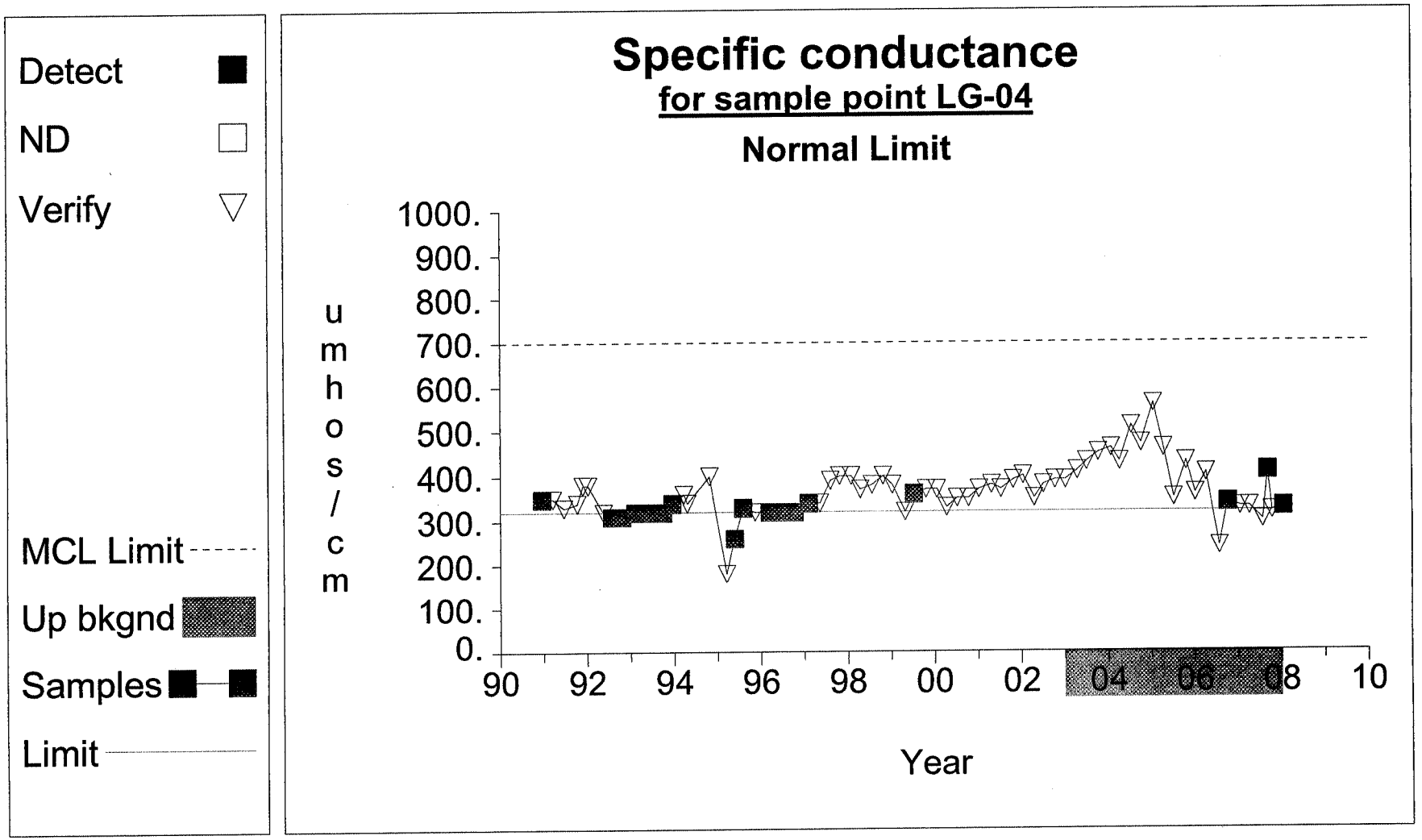
Graph 95

Up vs. Down Prediction Limits



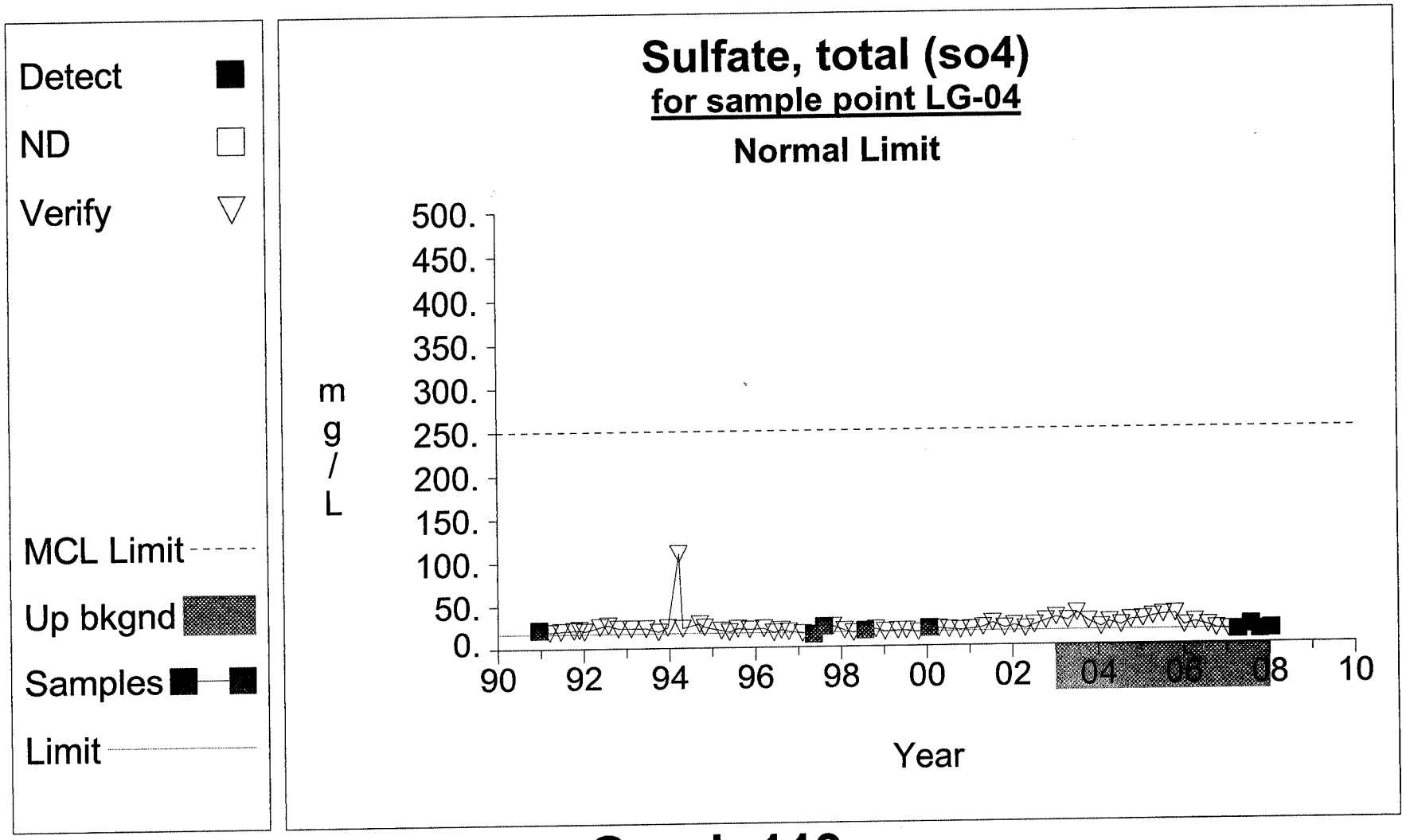
Graph 111

Up vs. Down Prediction Limits



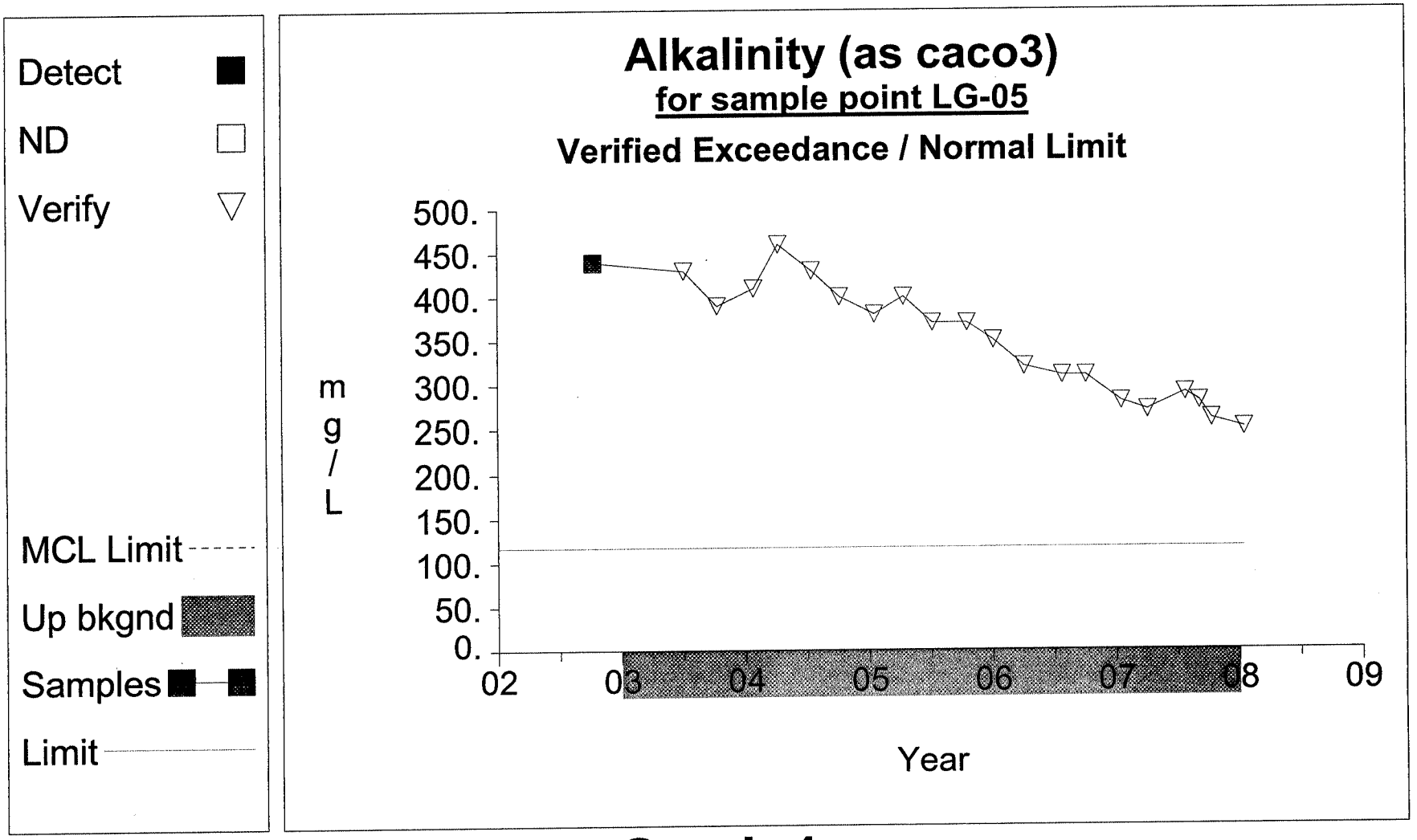
Graph 115

Up vs. Down Prediction Limits



Graph 119

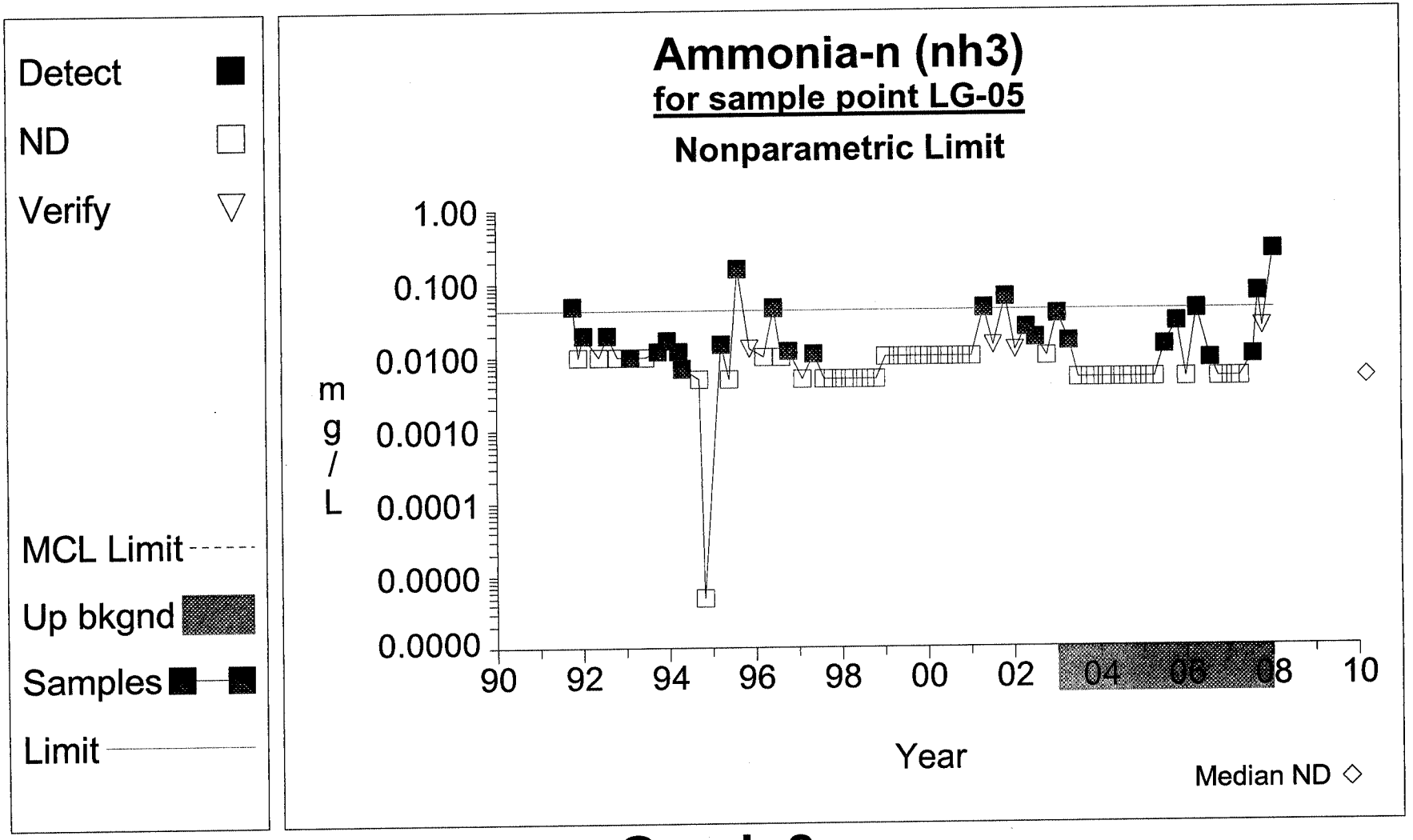
Up vs. Down Prediction Limits



Graph 4

Analysis prepared on: 1/22/2009

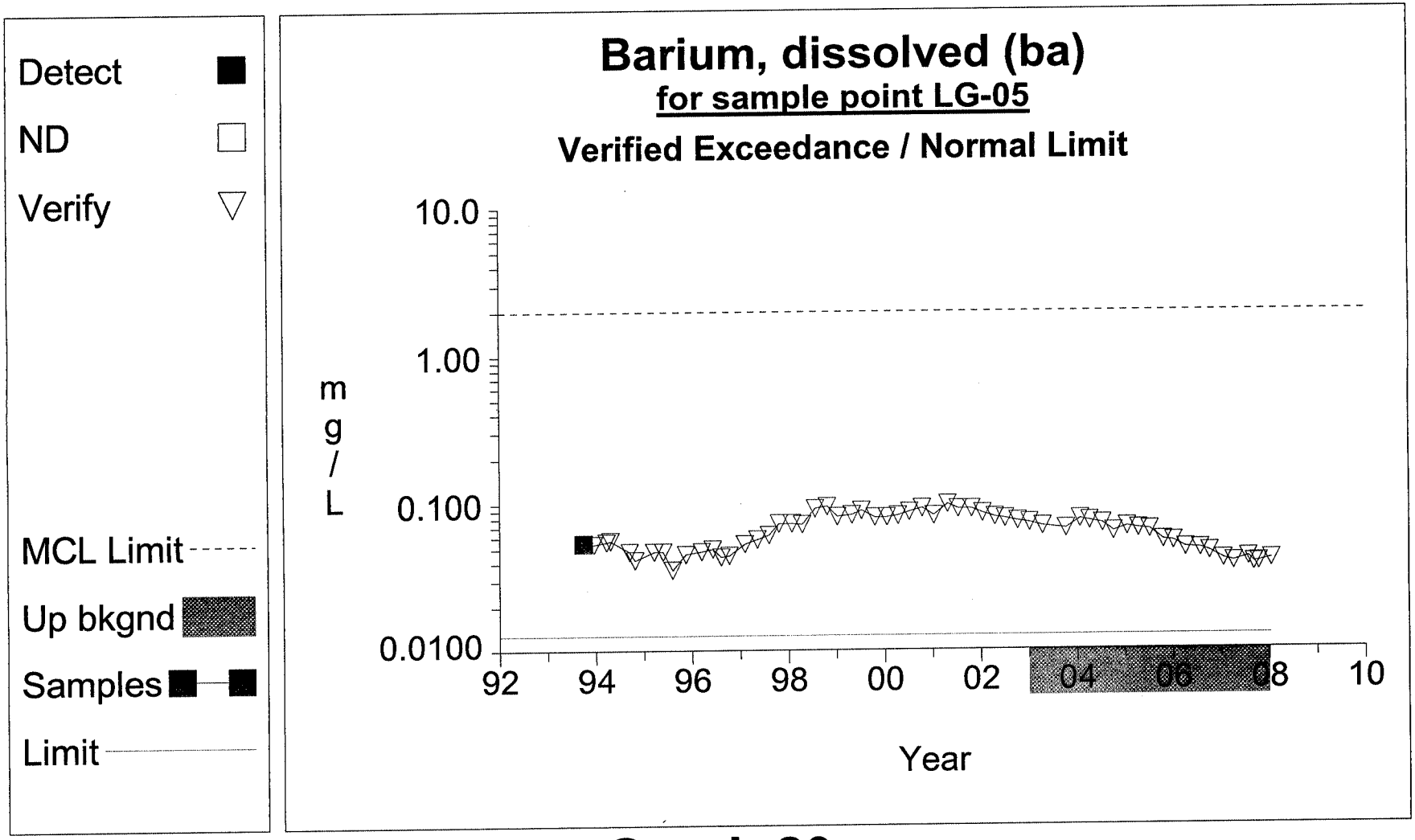
Up vs. Down Prediction Limits



Graph 8

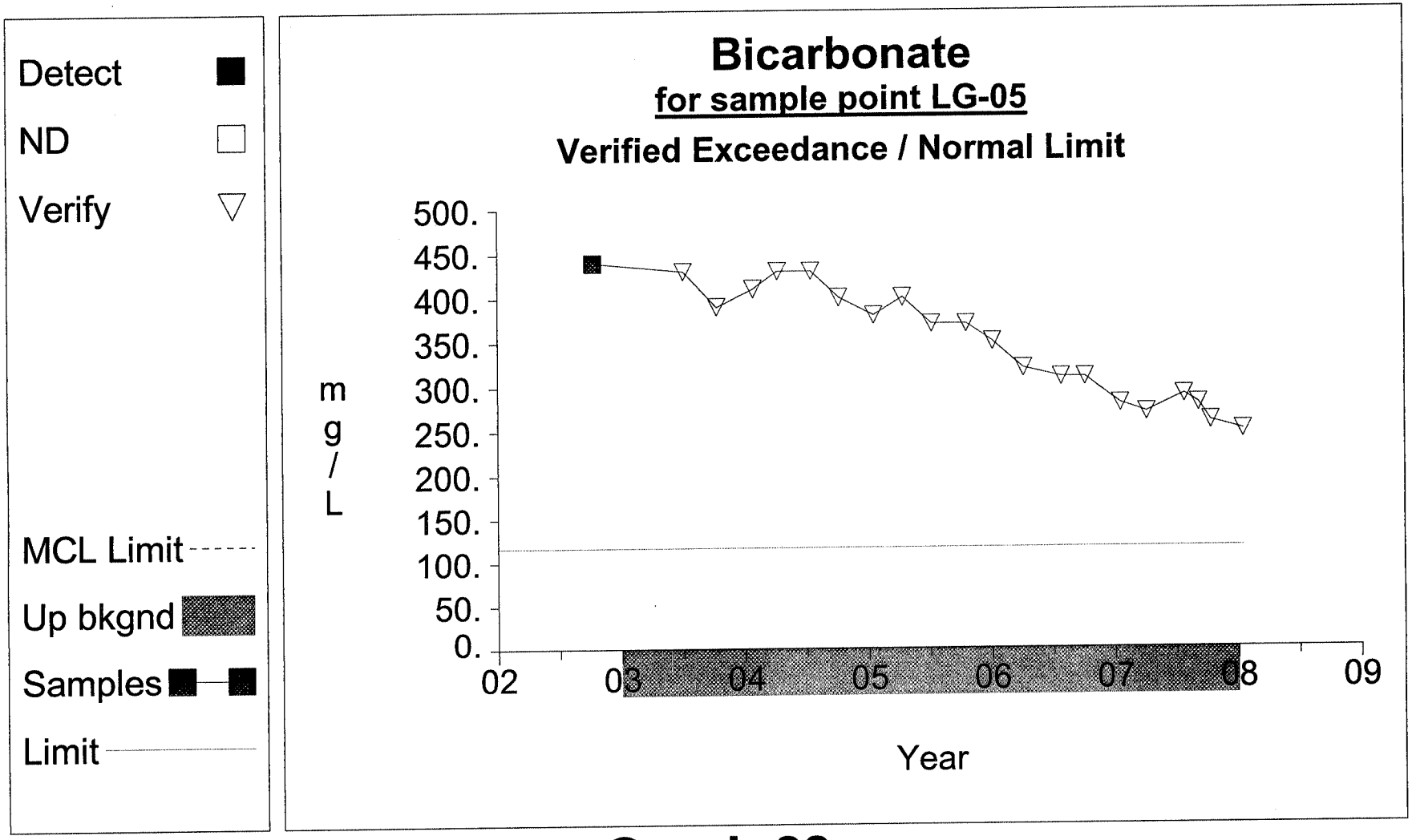
Prepared by: Snohomish County Solid Waste

Up vs. Down Prediction Limits



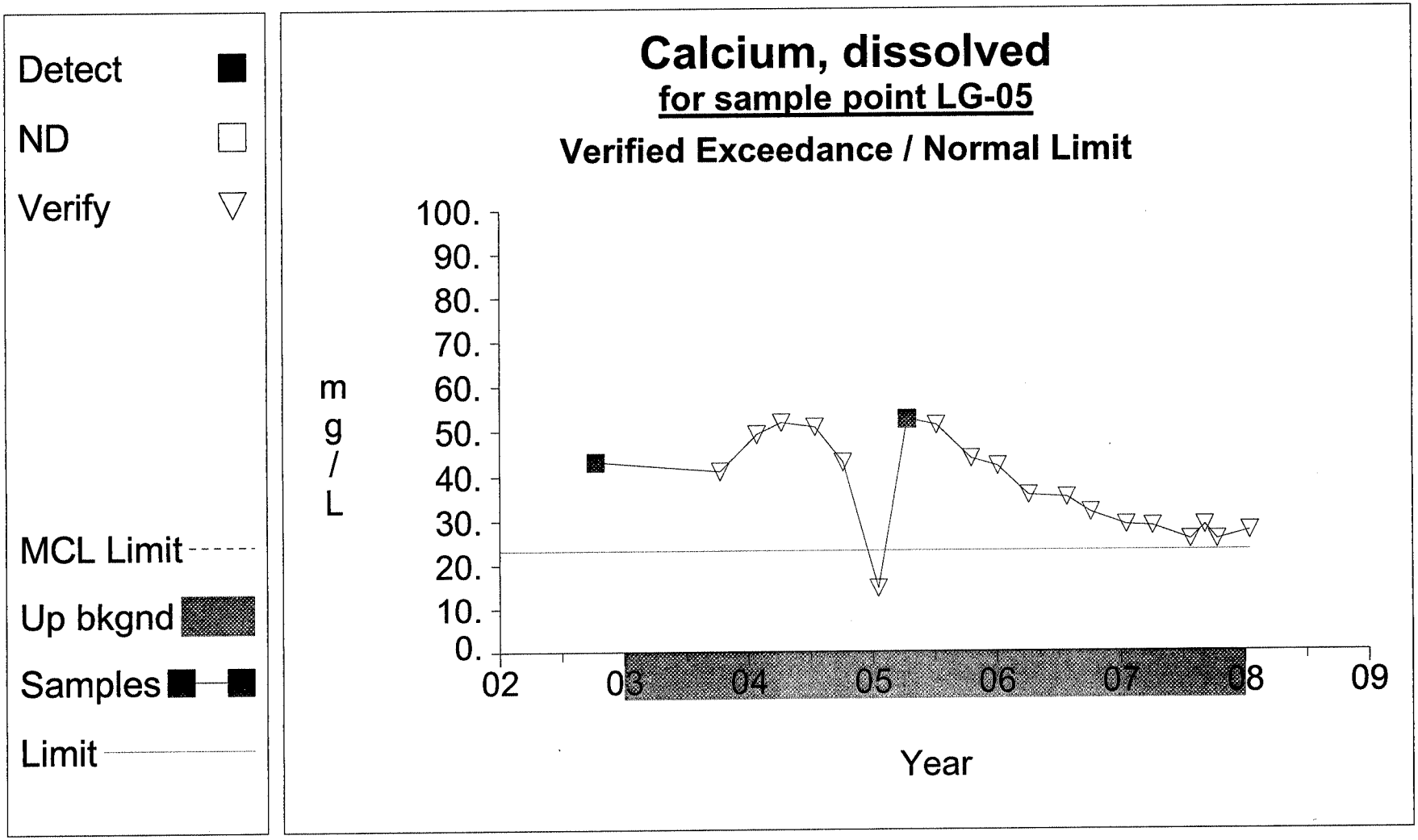
Graph 20

Up vs. Down Prediction Limits



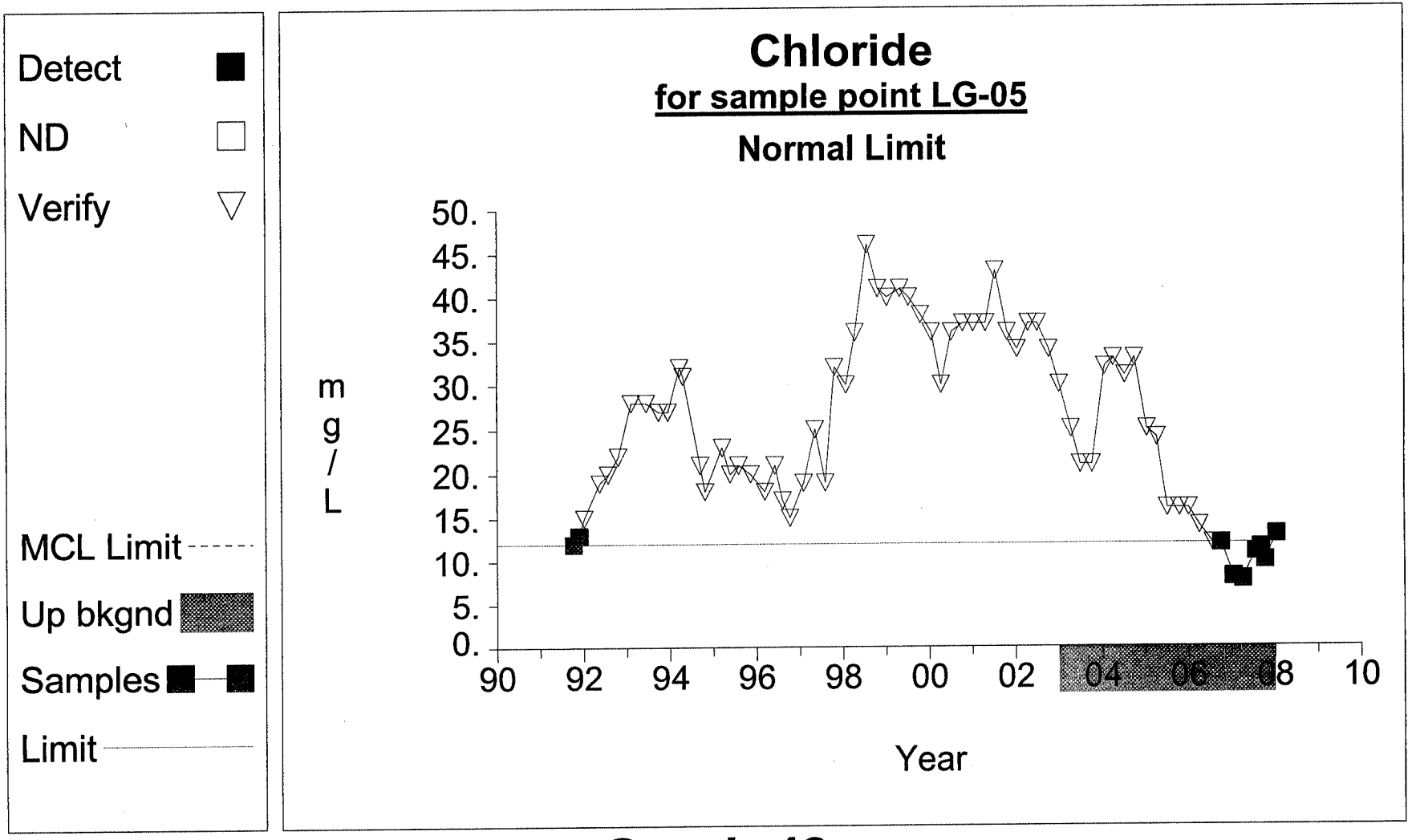
Graph 28

Up vs. Down Prediction Limits



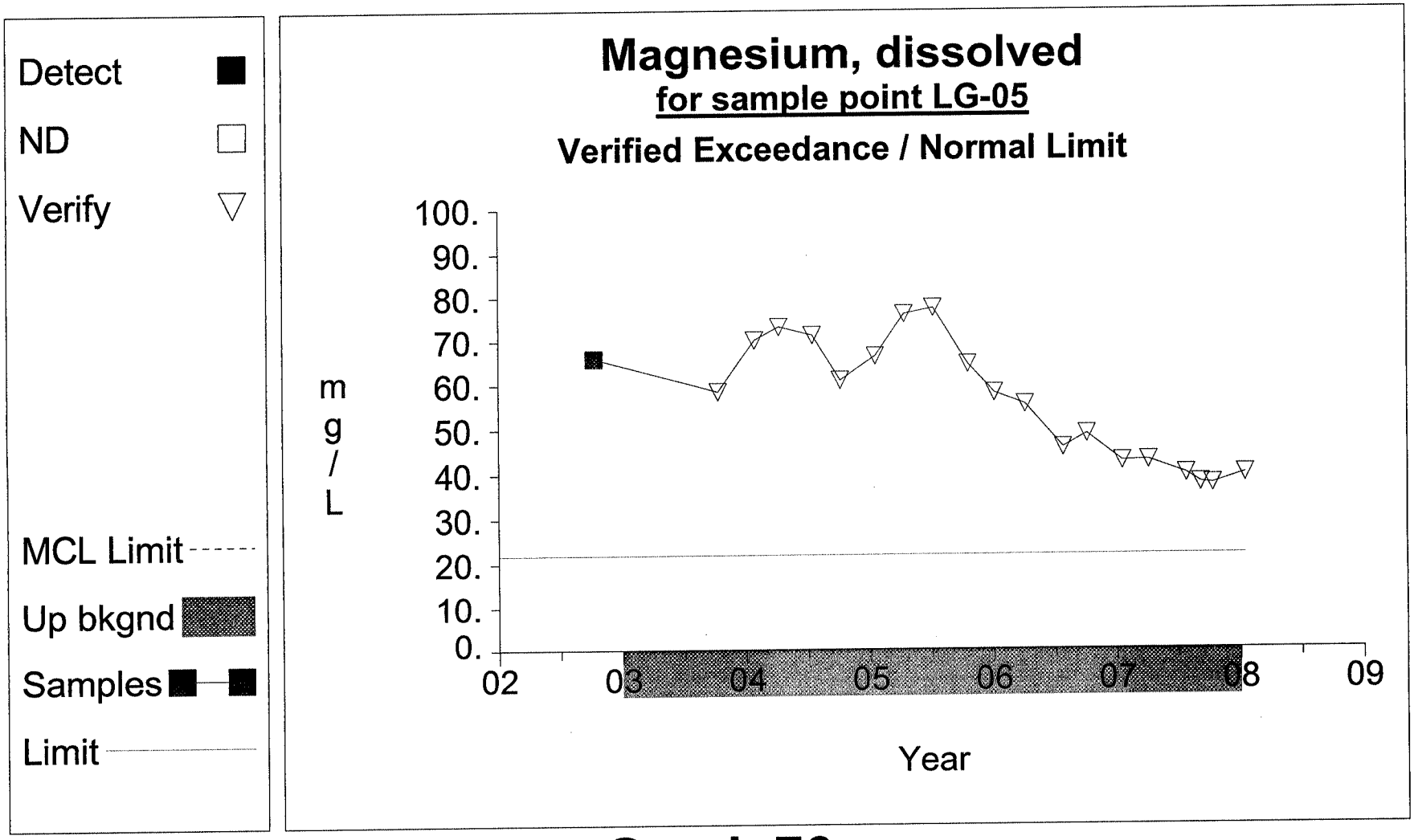
Graph 40

Up vs. Down Prediction Limits



Graph 48

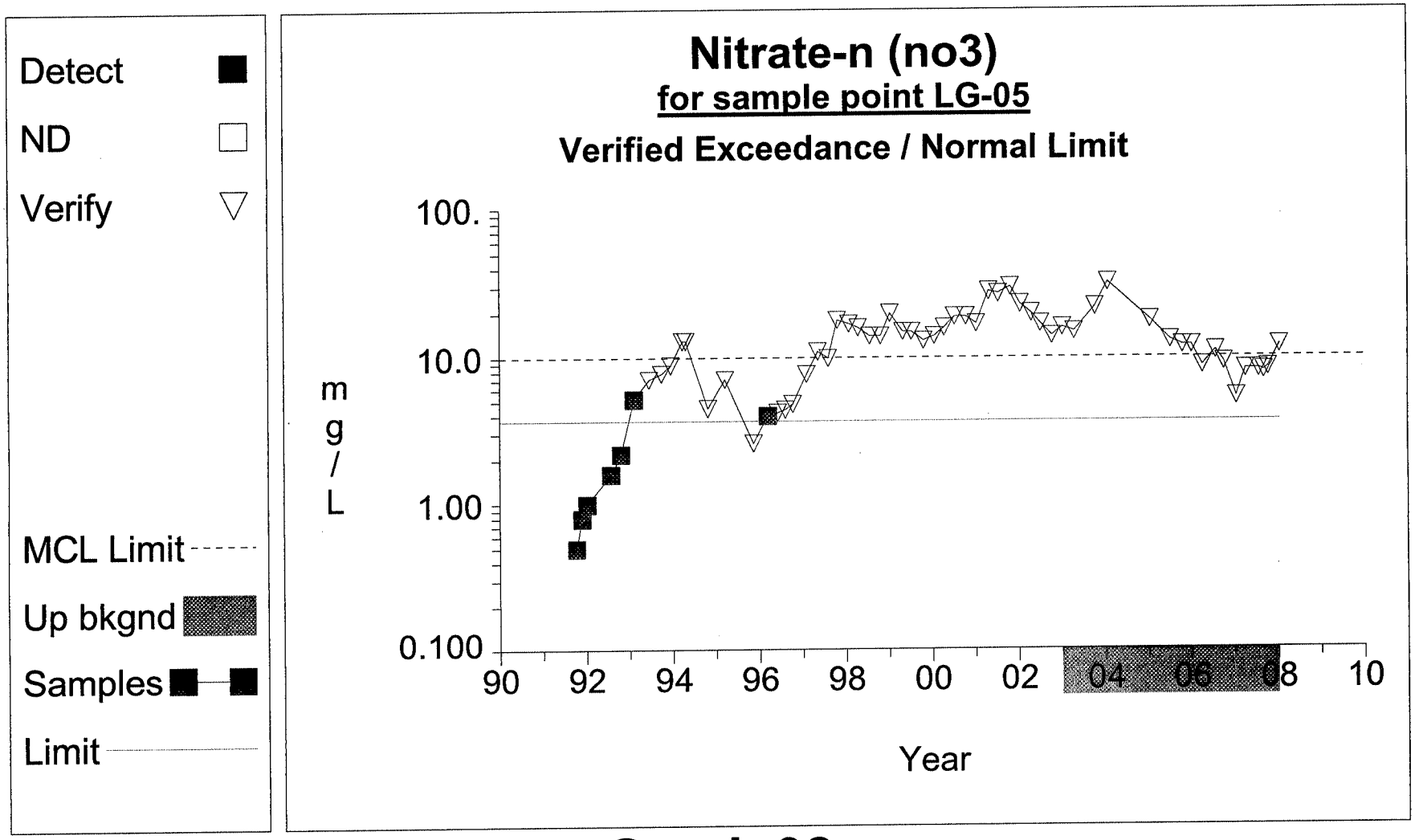
Up vs. Down Prediction Limits



Graph 76

Analysis prepared on: 1/22/2009

Up vs. Down Prediction Limits

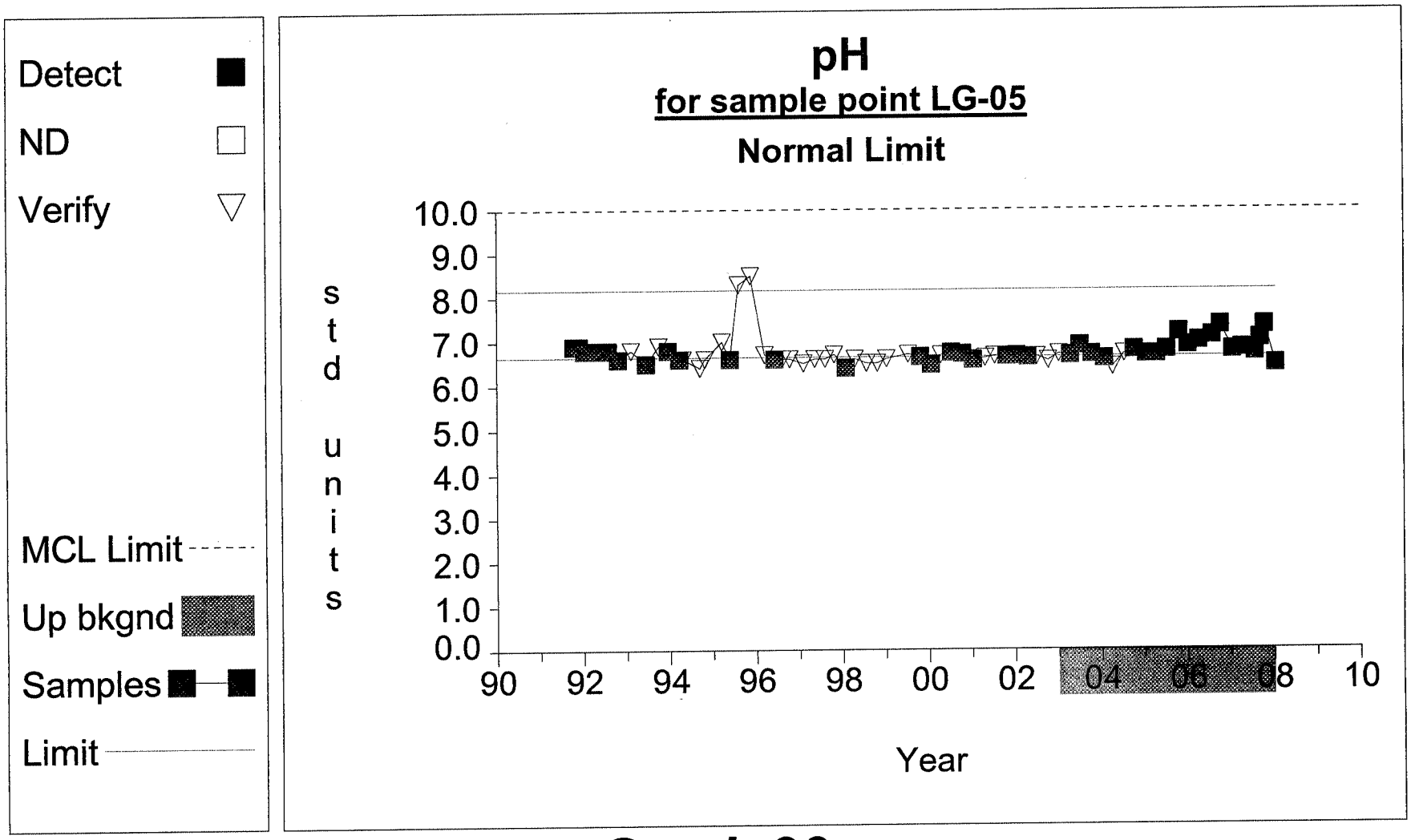


Graph 92

Prepared by: Snohomish County Solid Waste

Analysis prepared on: 1/22/2009

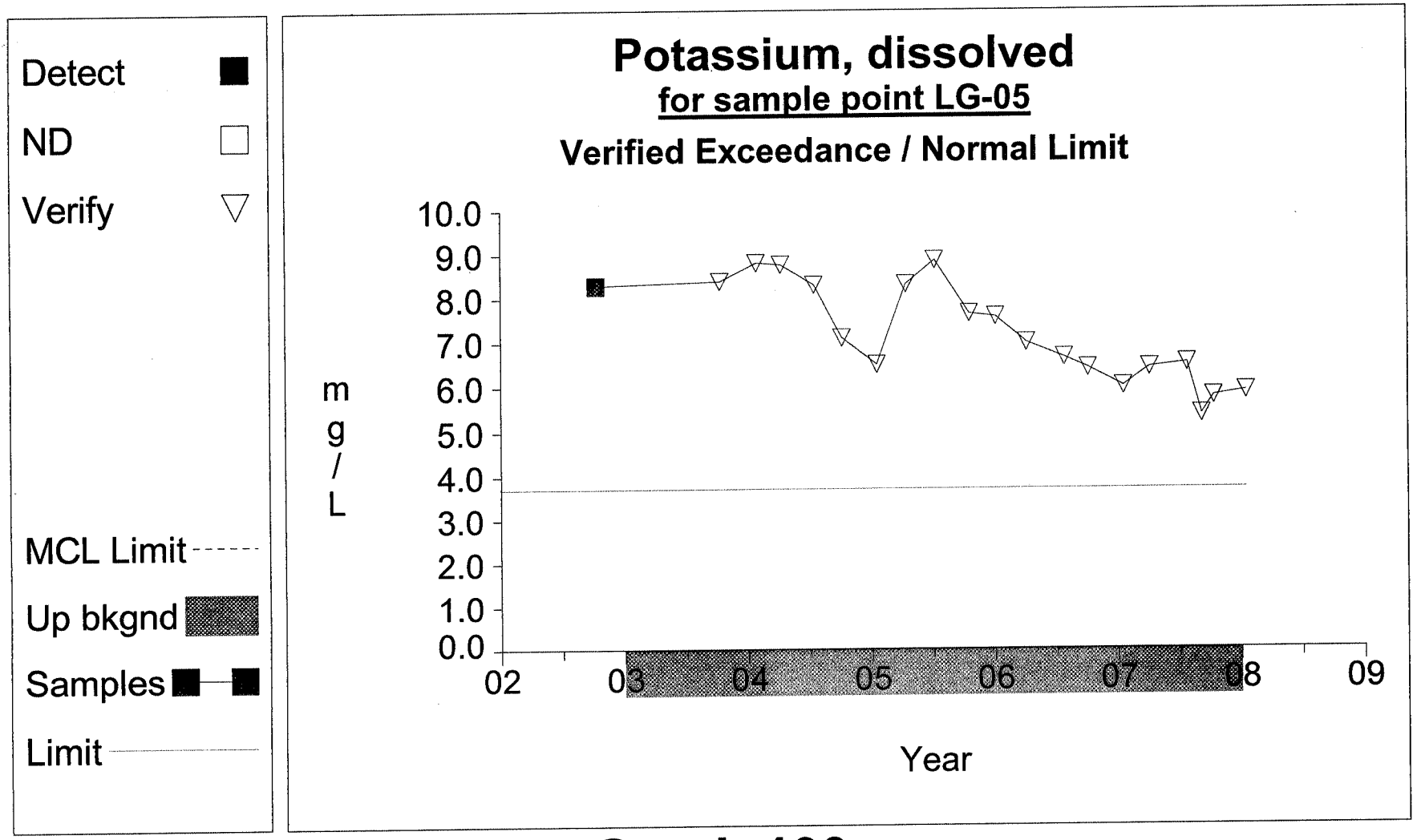
Up vs. Down Prediction Limits



Graph 96

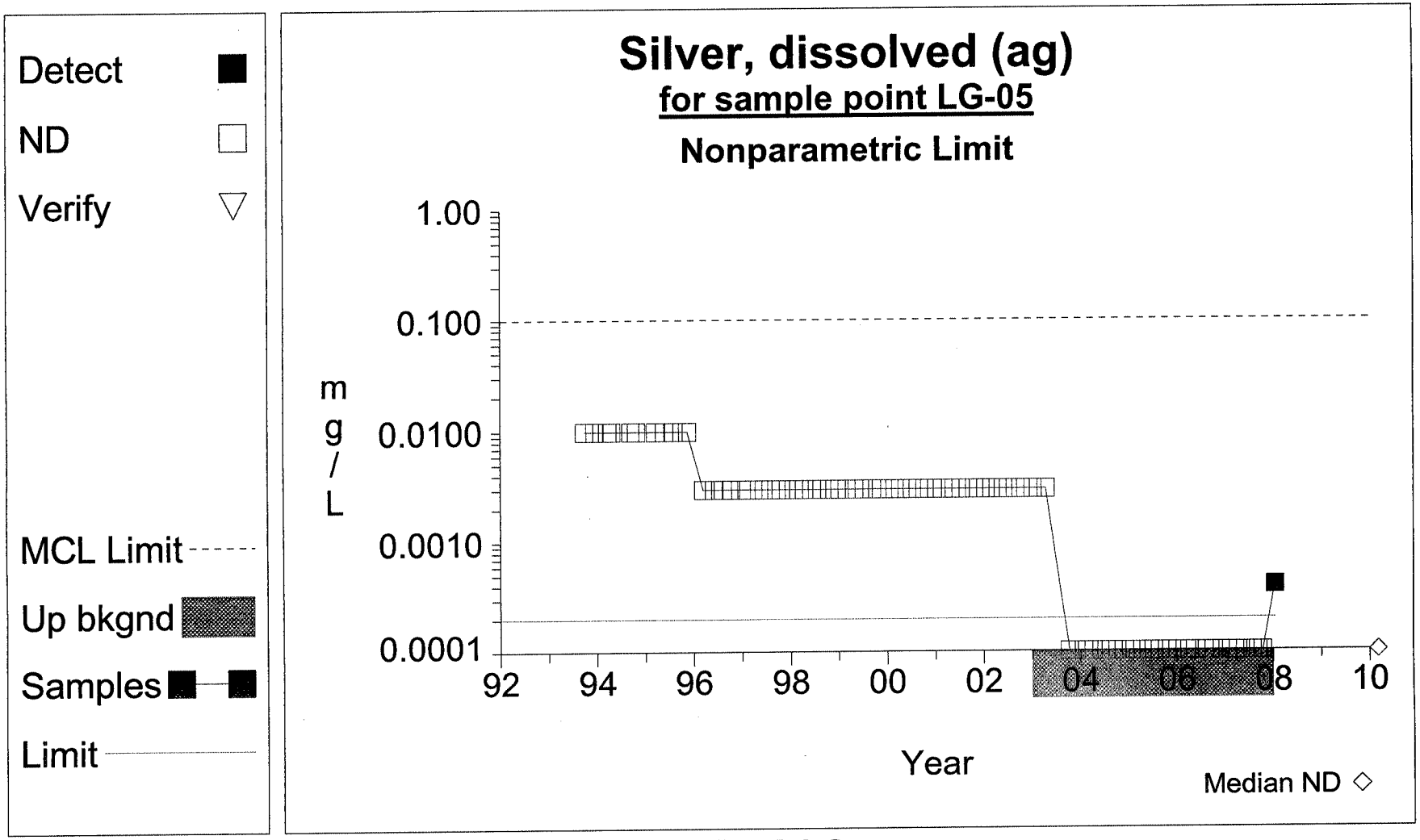
Prepared by: Snohomish County Solid Waste

Up vs. Down Prediction Limits



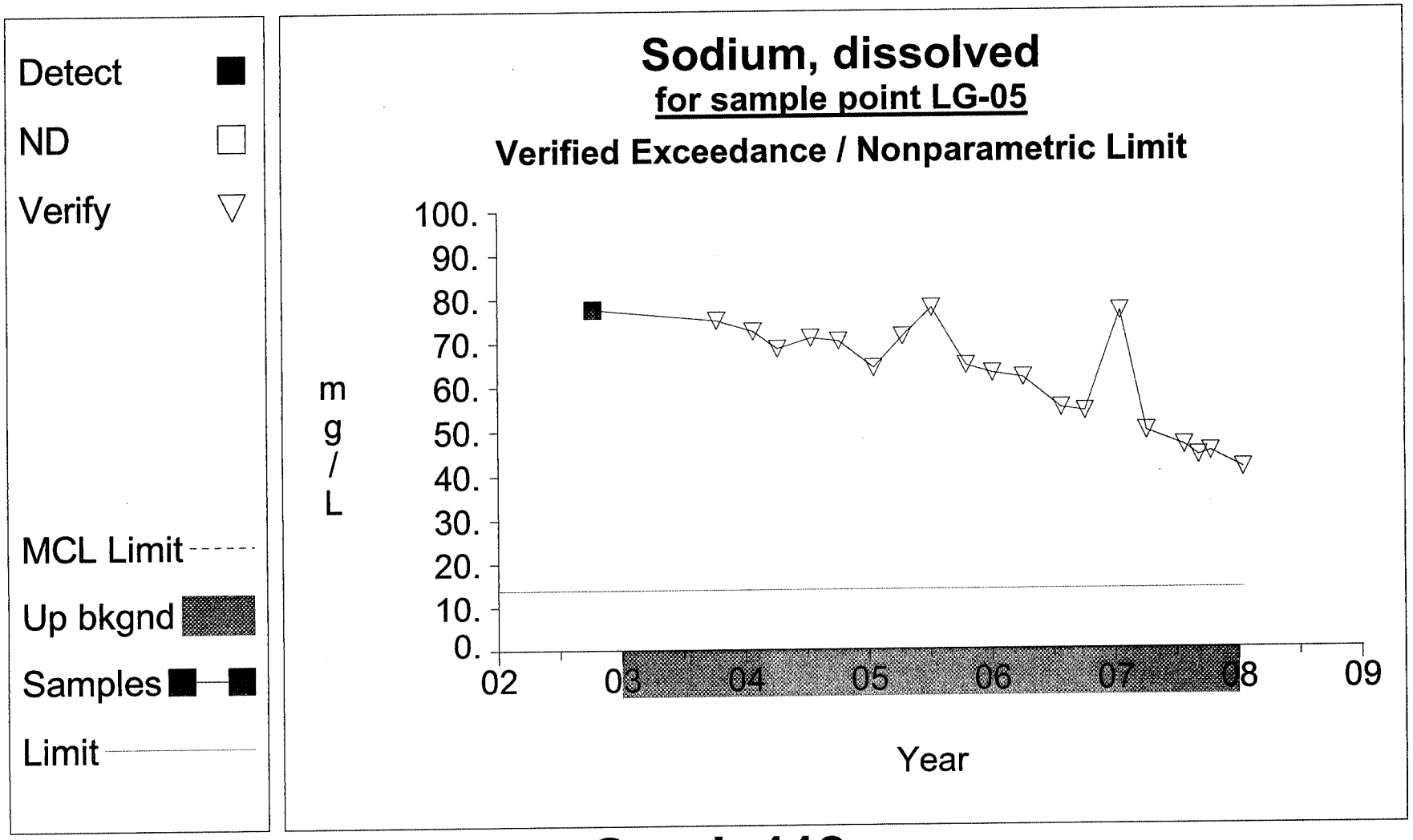
Graph 100

Up vs. Down Prediction Limits



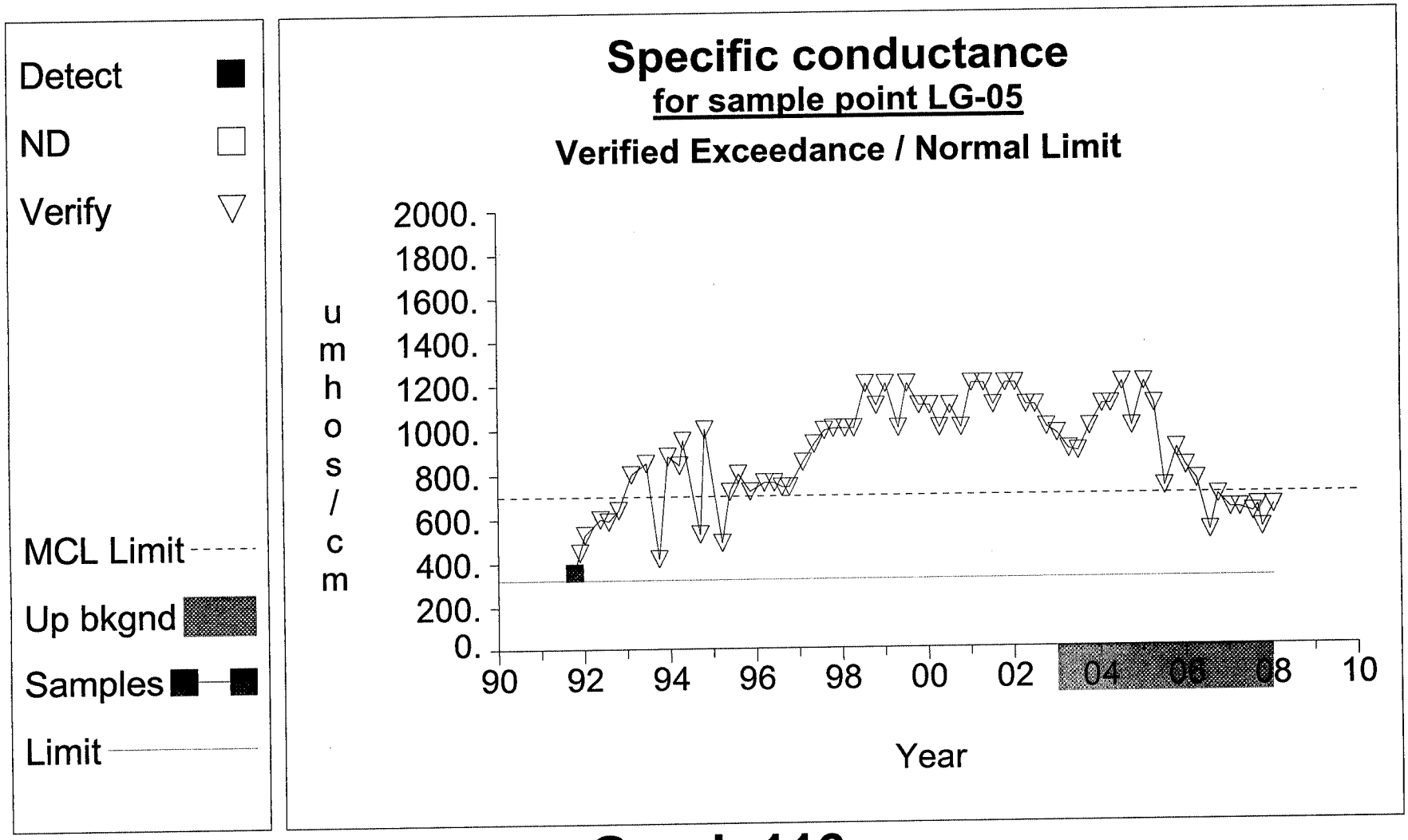
Graph 108

Up vs. Down Prediction Limits



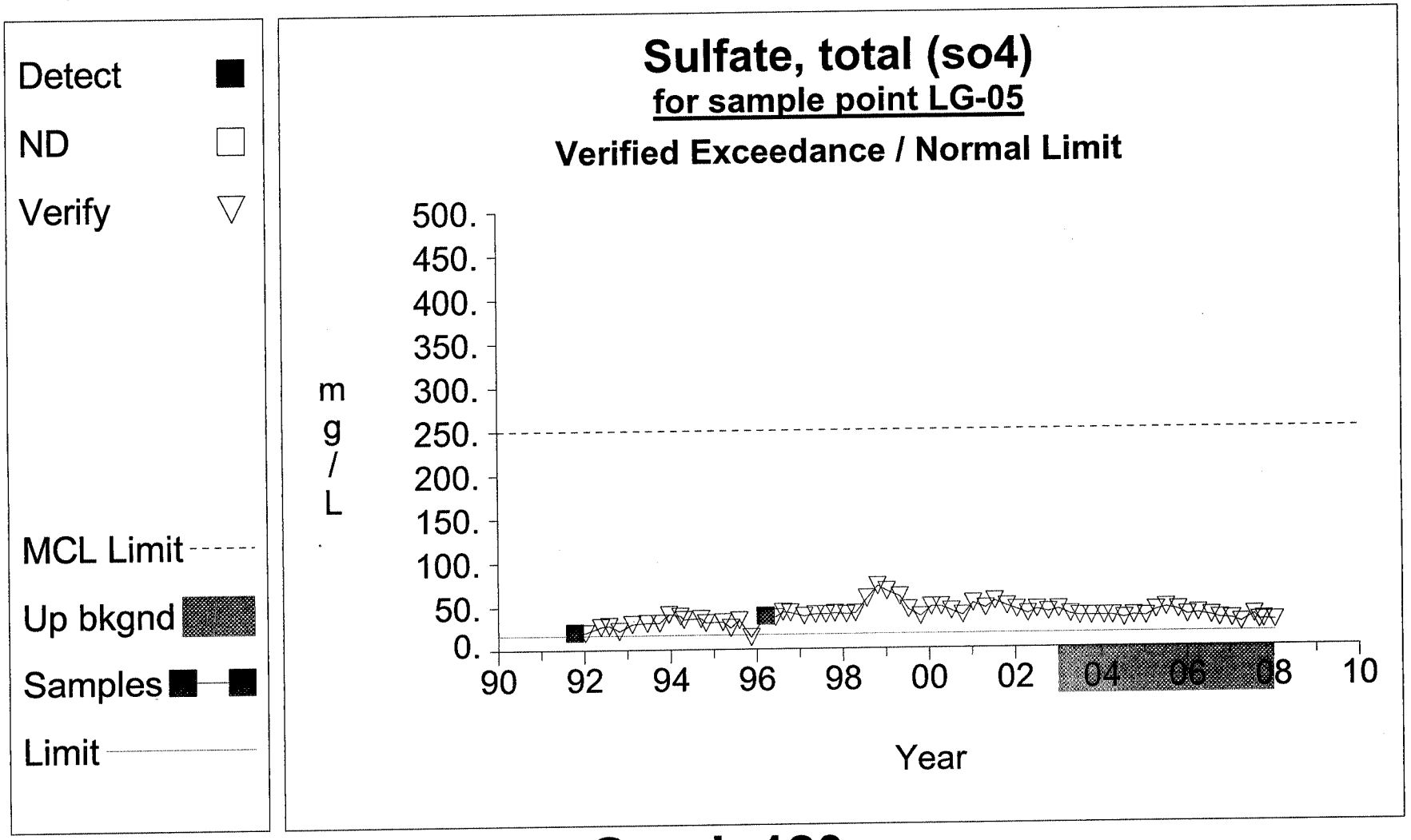
Graph 112

Up vs. Down Prediction Limits



Graph 116

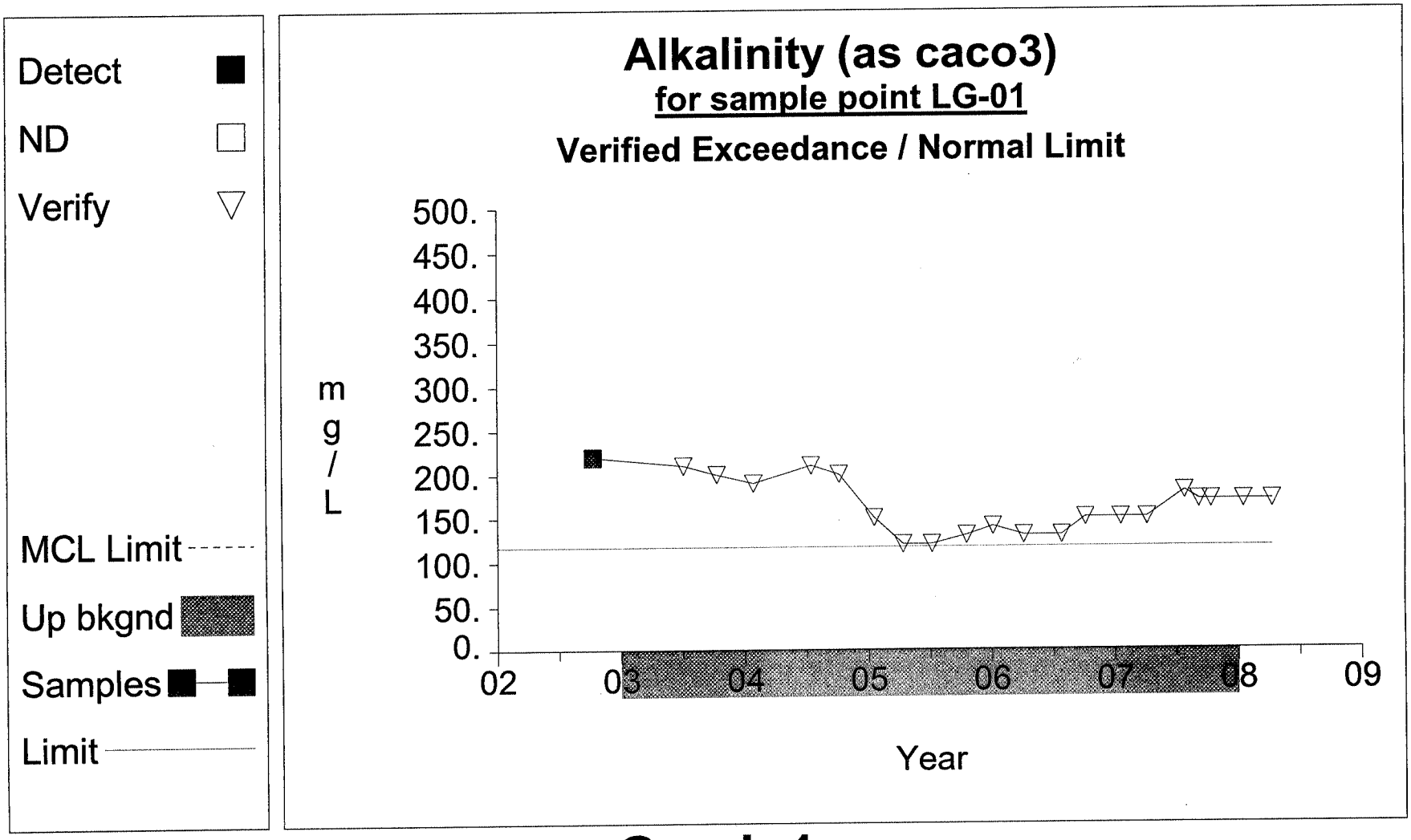
Up vs. Down Prediction Limits



Graph 120

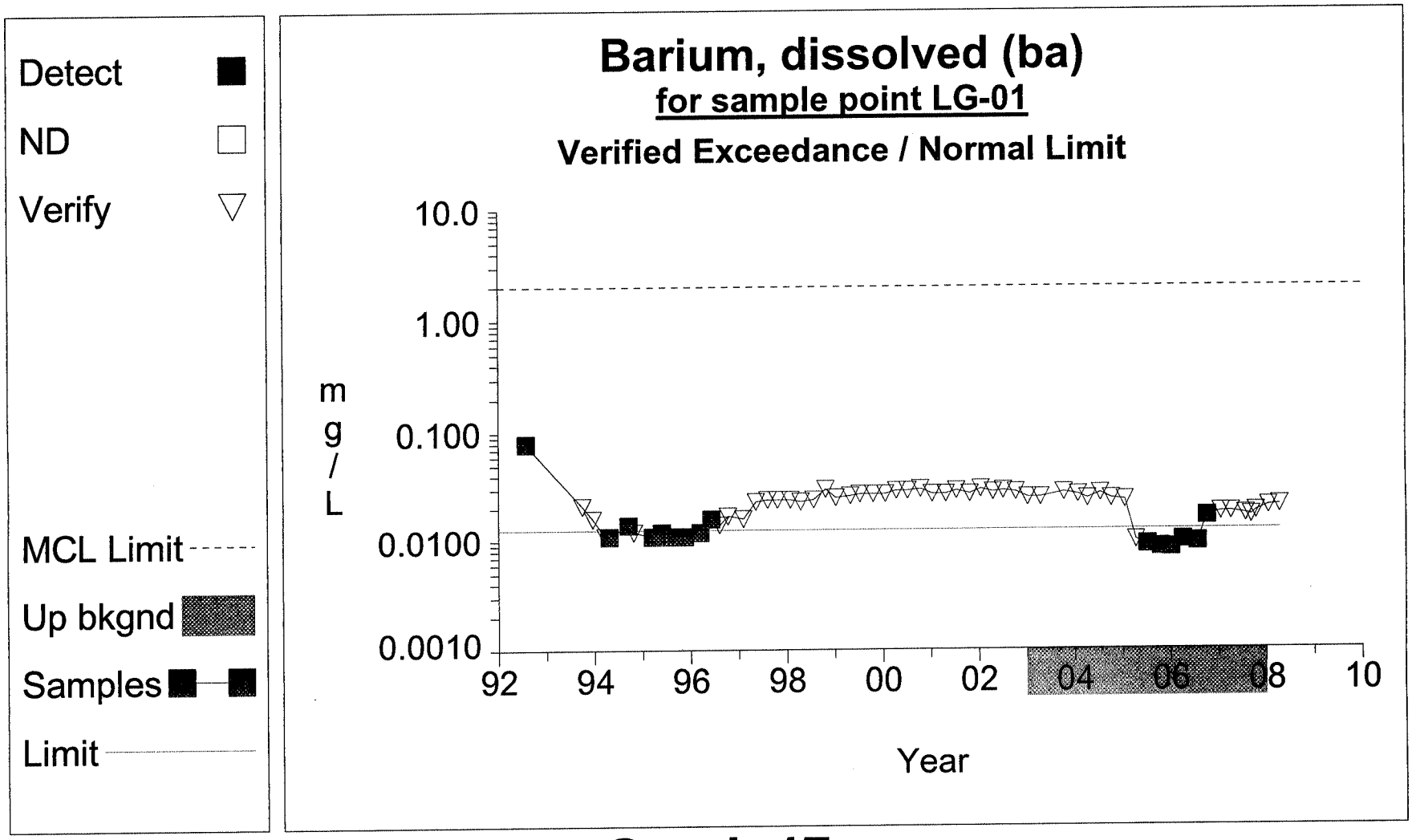
2ND QUARTER

Up vs. Down Prediction Limits



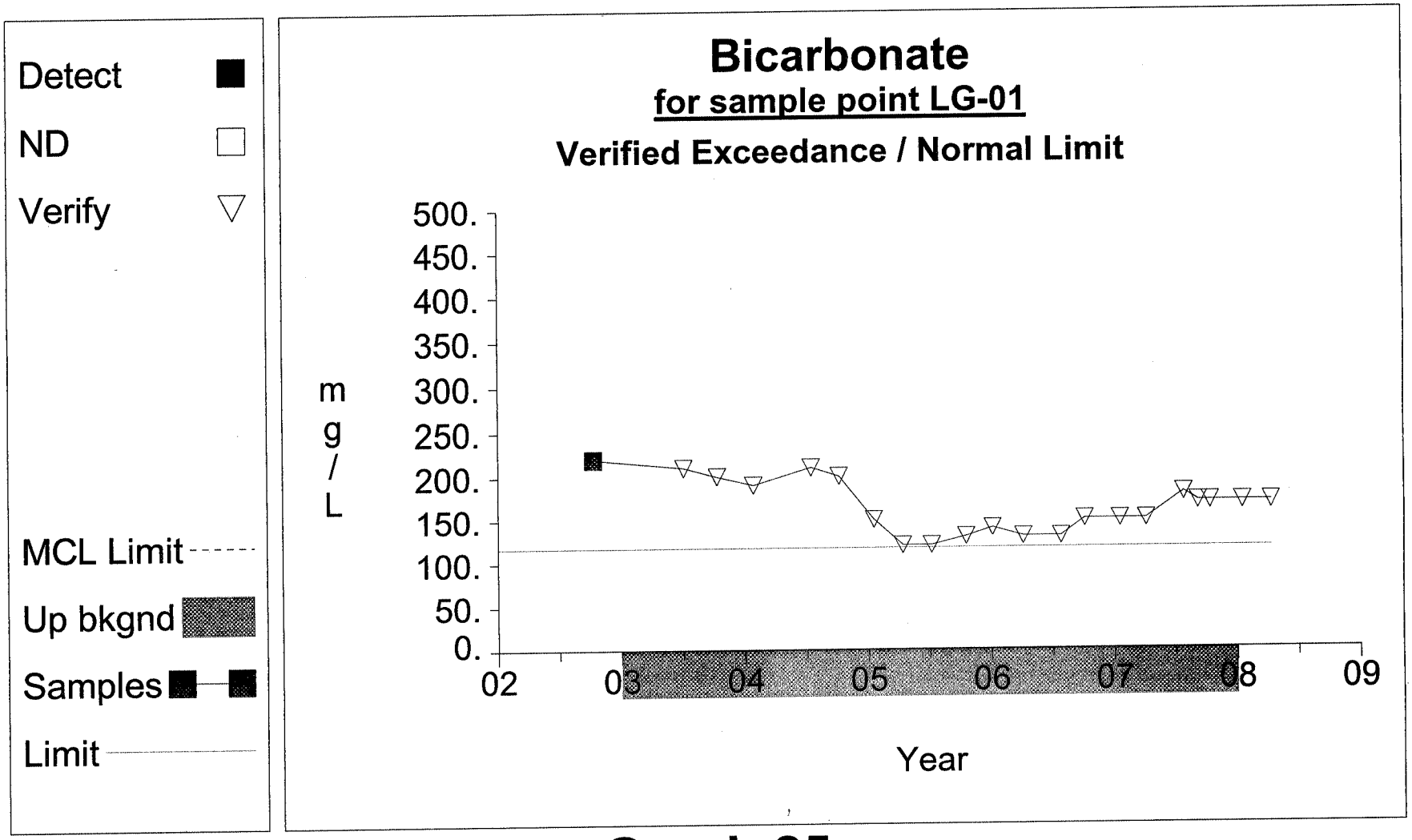
Graph 1

Up vs. Down Prediction Limits



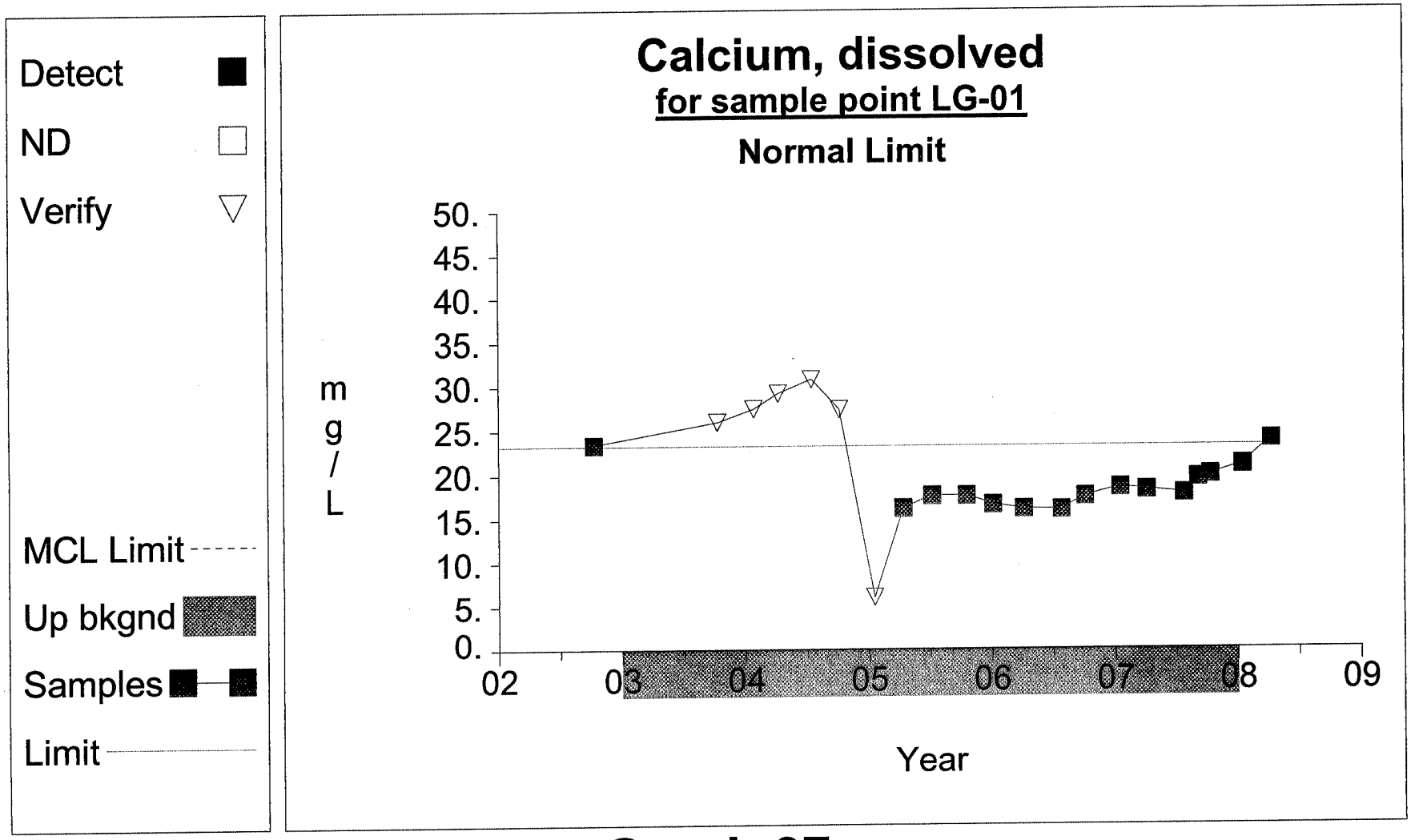
Graph 17

Up vs. Down Prediction Limits



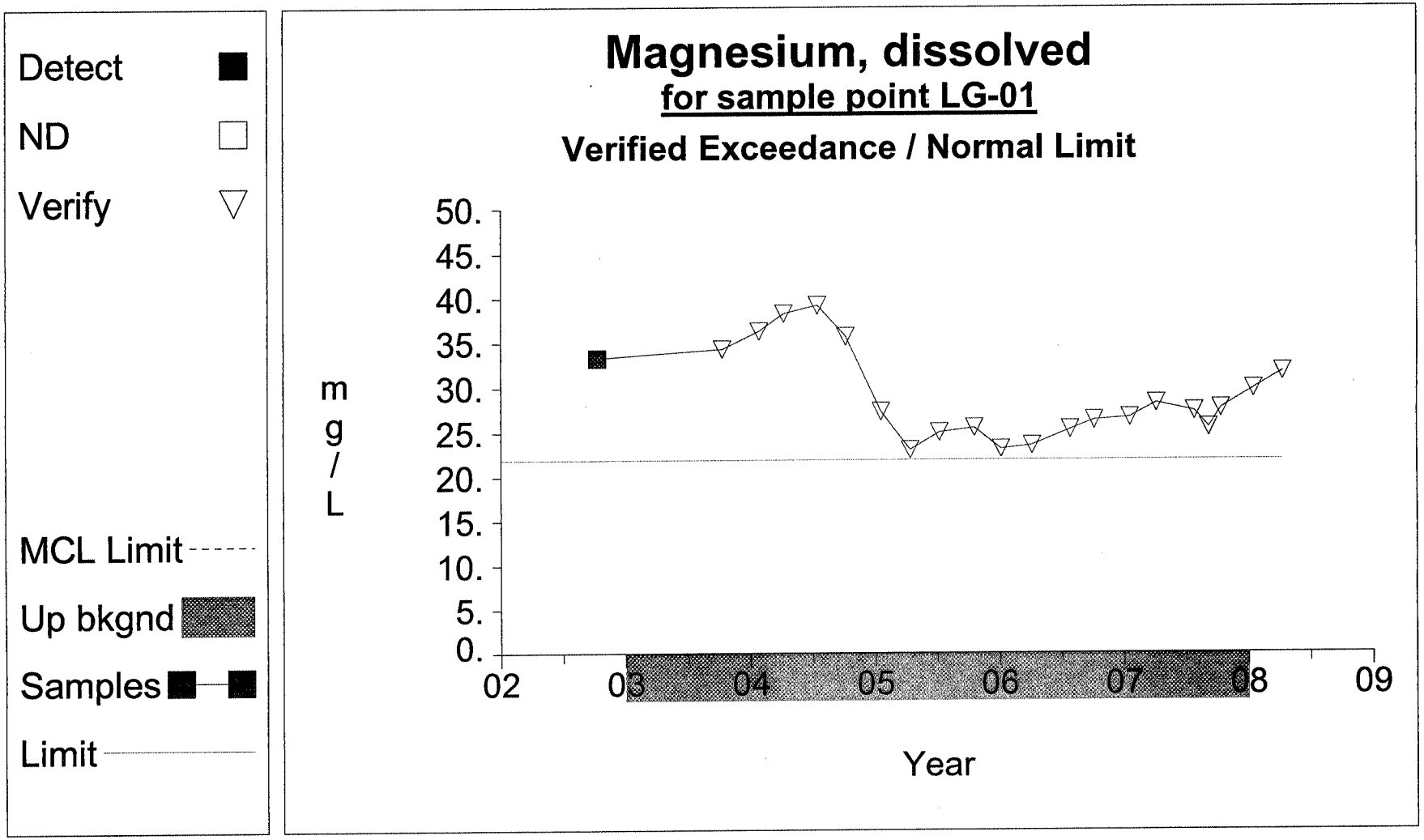
Graph 25

Up vs. Down Prediction Limits



Graph 37

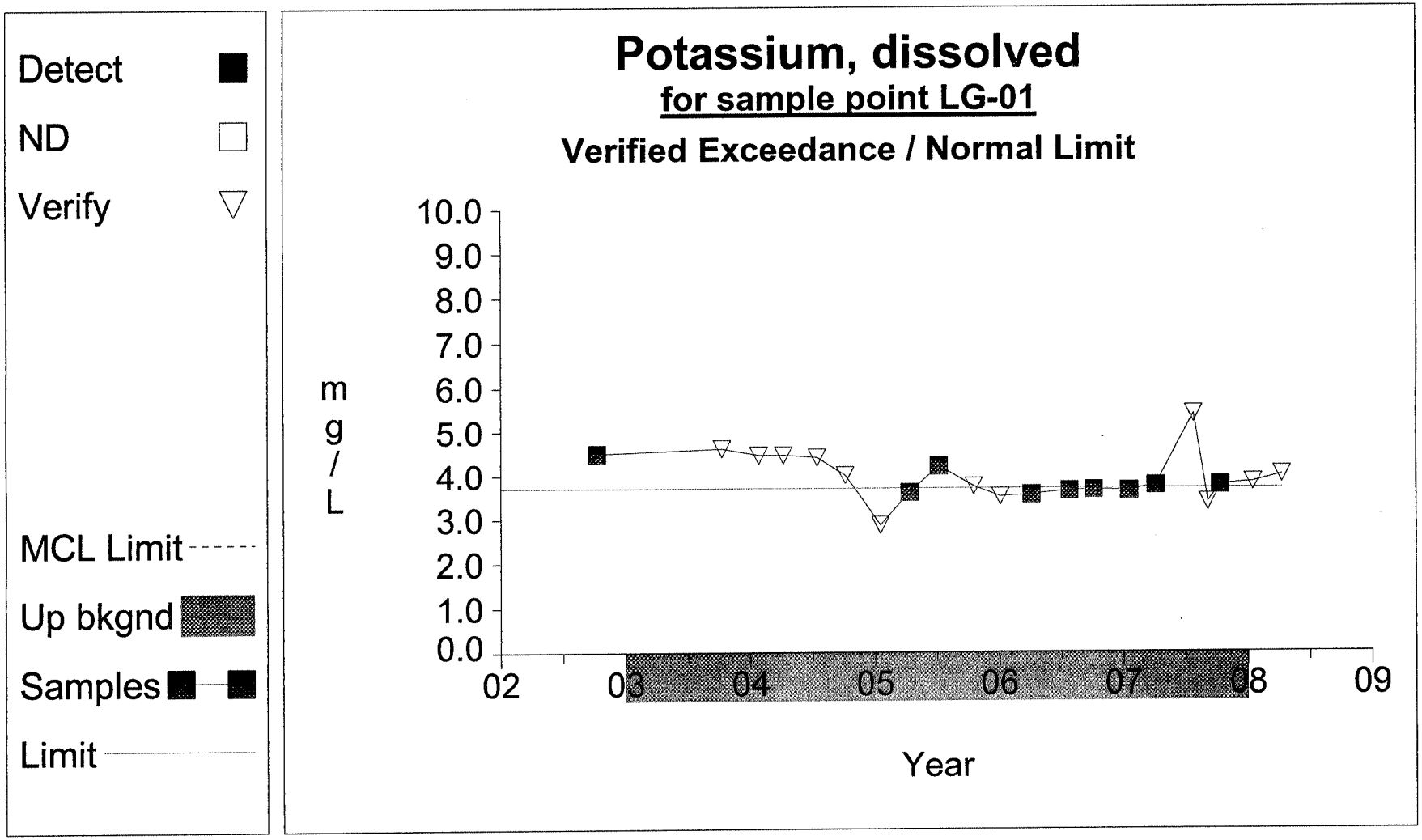
Up vs. Down Prediction Limits



Graph 73

Analysis prepared on: 1/22/2009

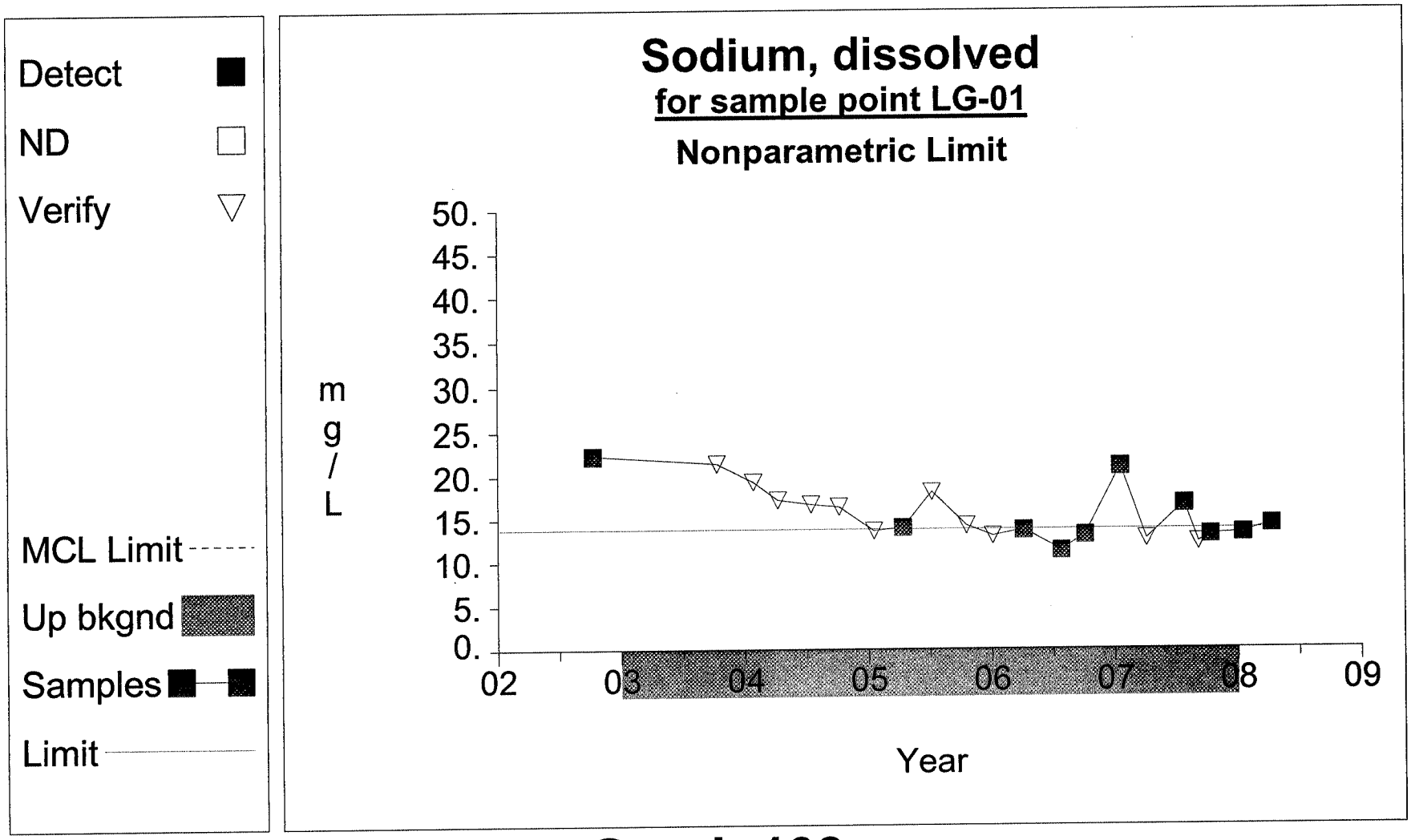
Up vs. Down Prediction Limits



Graph 97

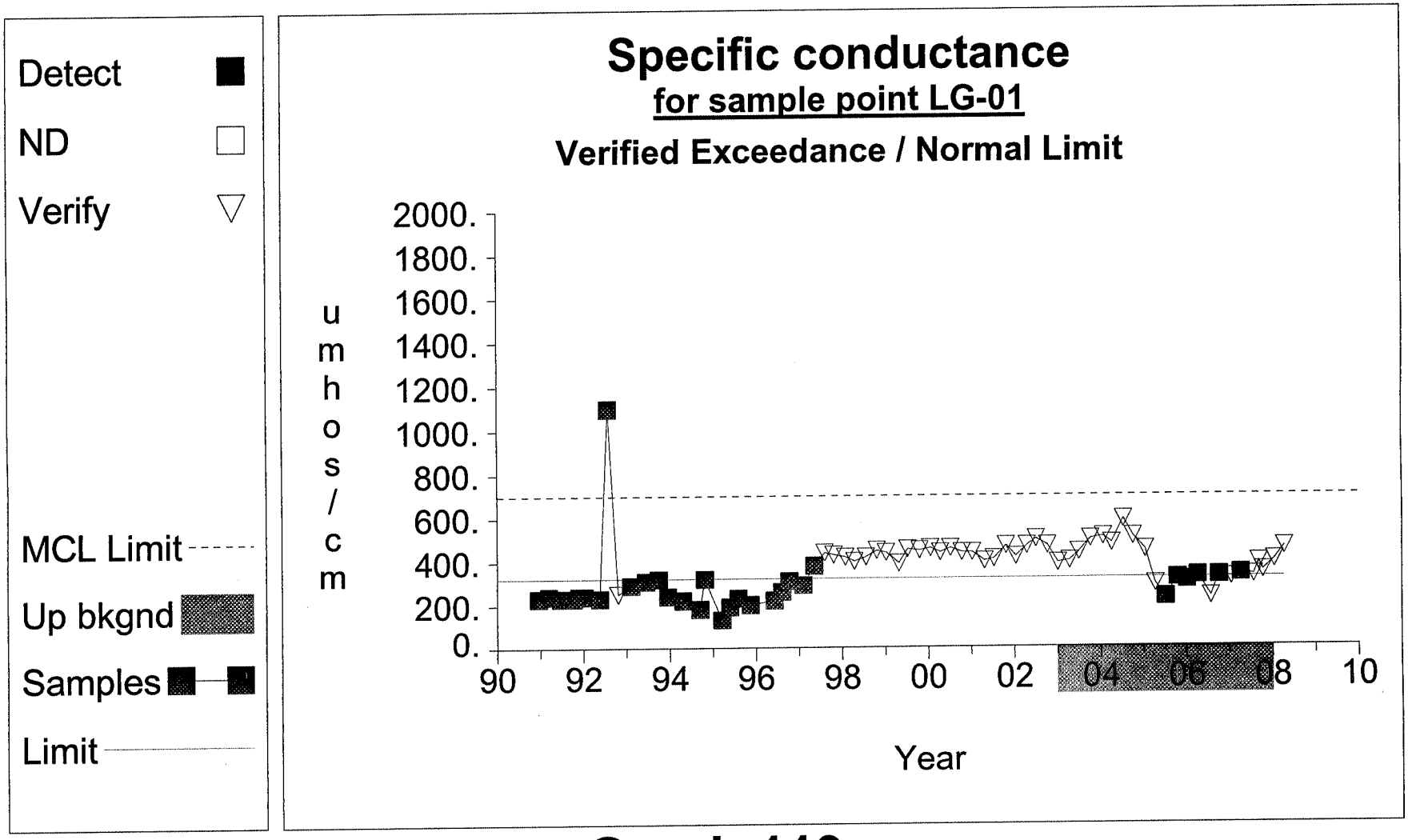
Prepared by: Snohomish County Solid Waste

Up vs. Down Prediction Limits



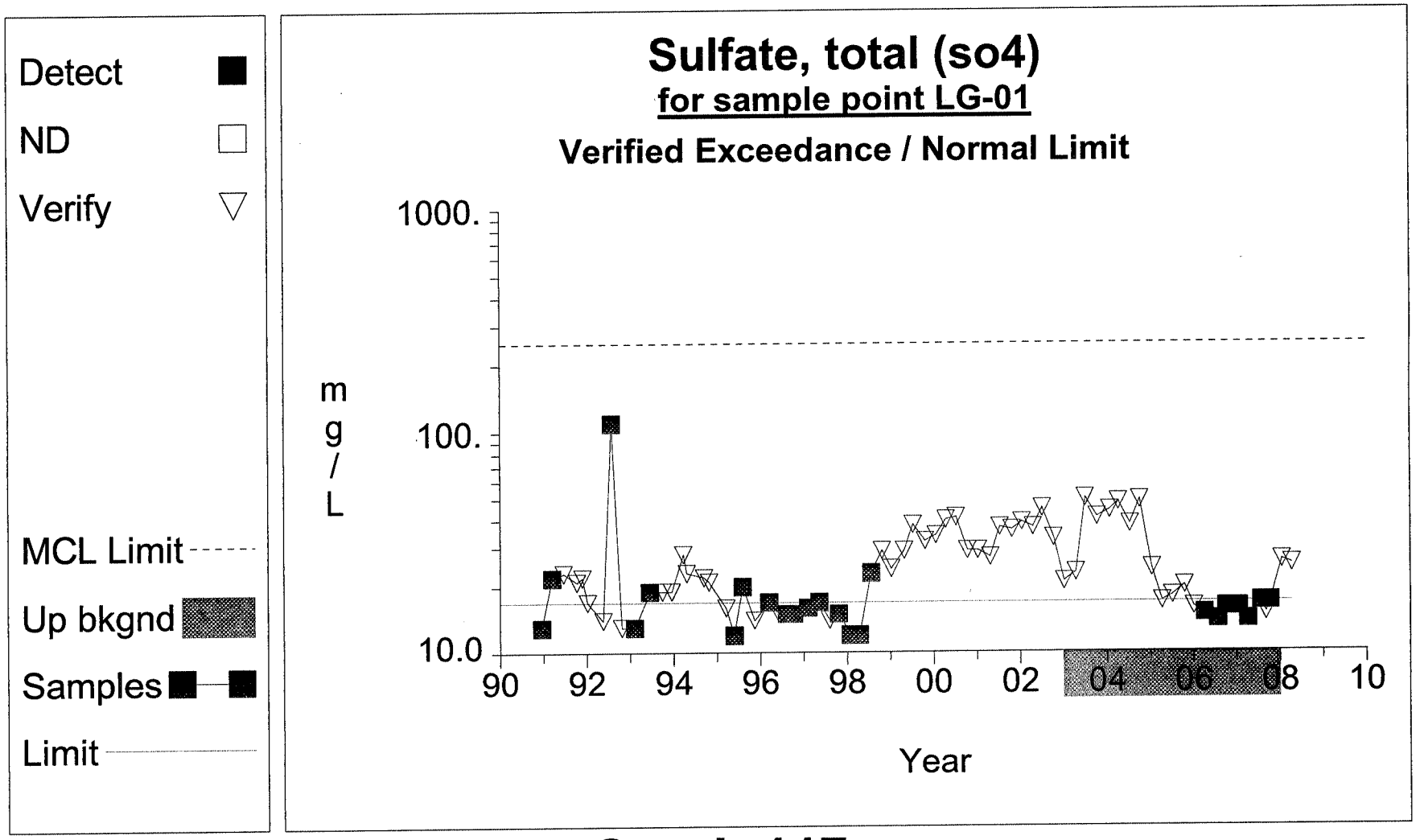
Graph 109

Up vs. Down Prediction Limits



Graph 113

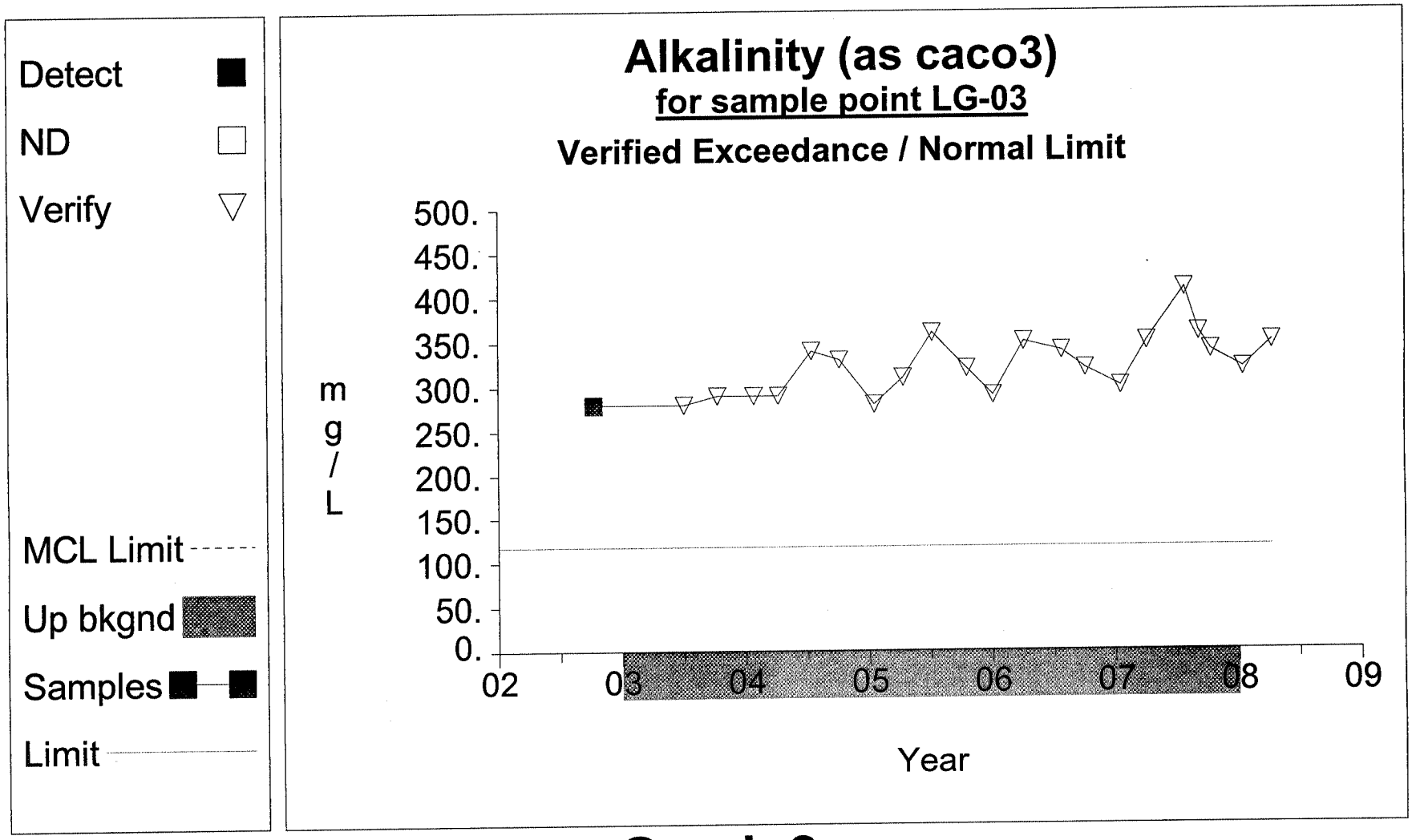
Up vs. Down Prediction Limits



Graph 117

Analysis prepared on: 1/22/2009

Up vs. Down Prediction Limits

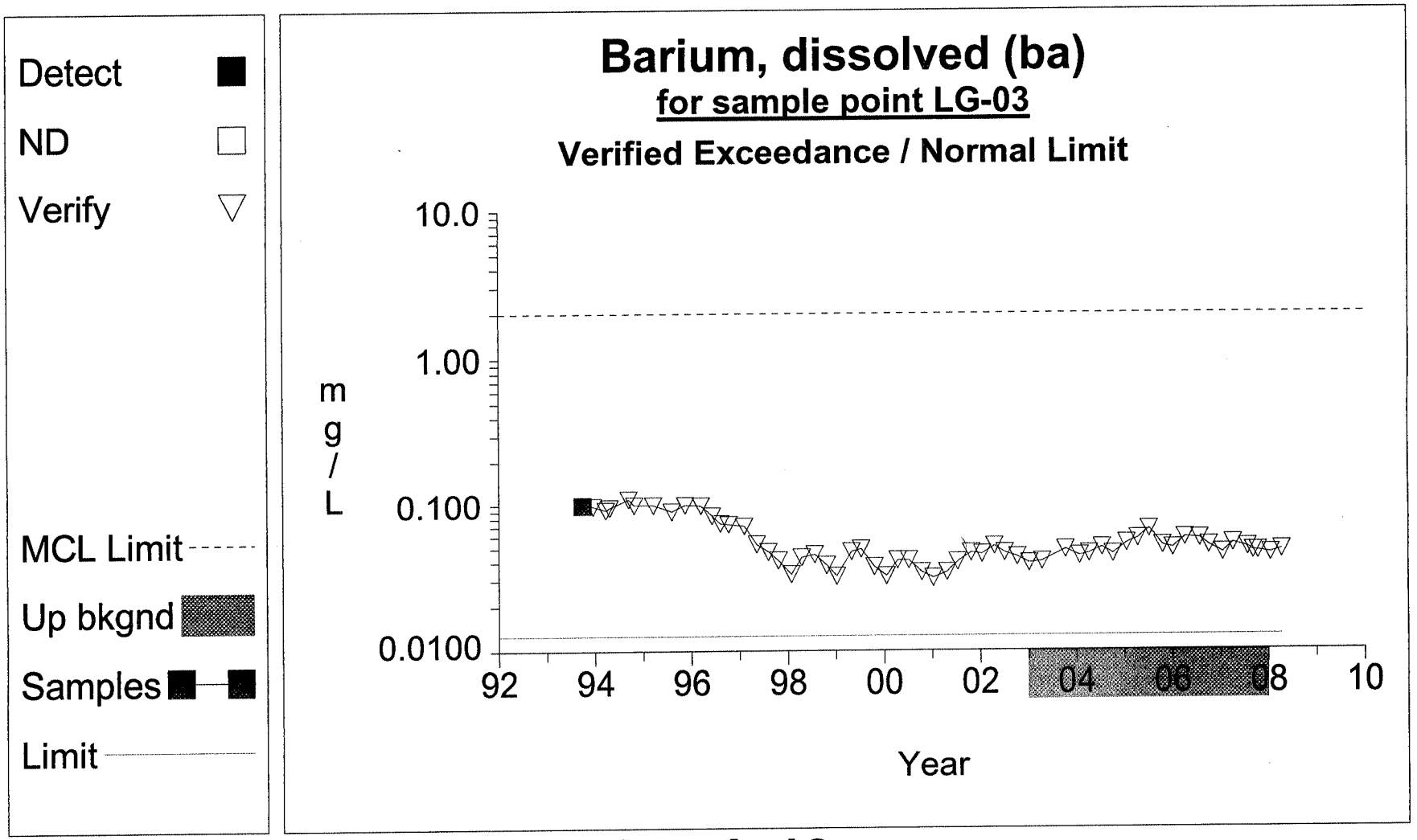


Graph 2

Prepared by: Snohomish County Solid Waste

Analysis prepared on: 1/22/2009

Up vs. Down Prediction Limits

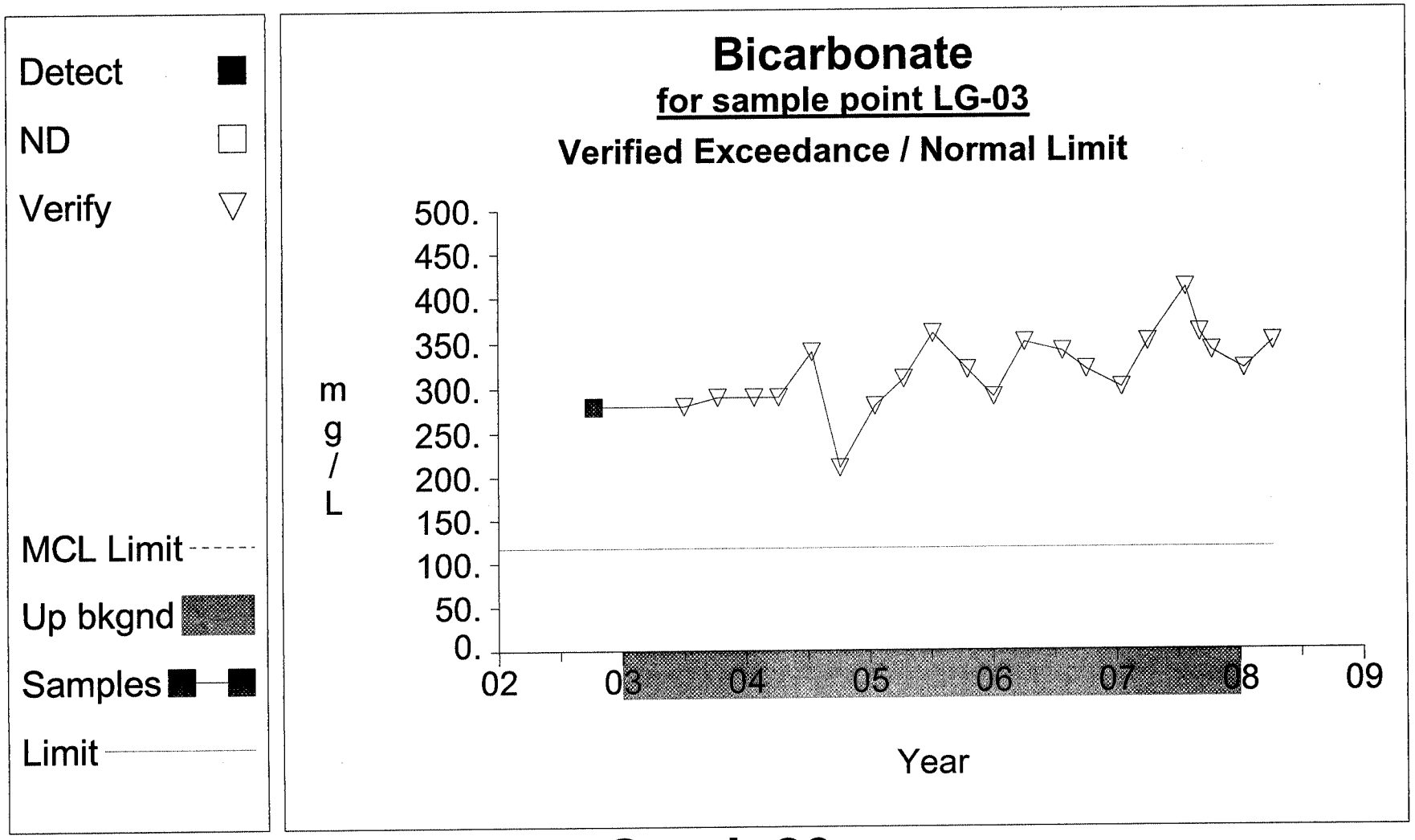


Graph 18

Prepared by: Snohomish County Solid Waste

Analysis prepared on: 1/22/2009

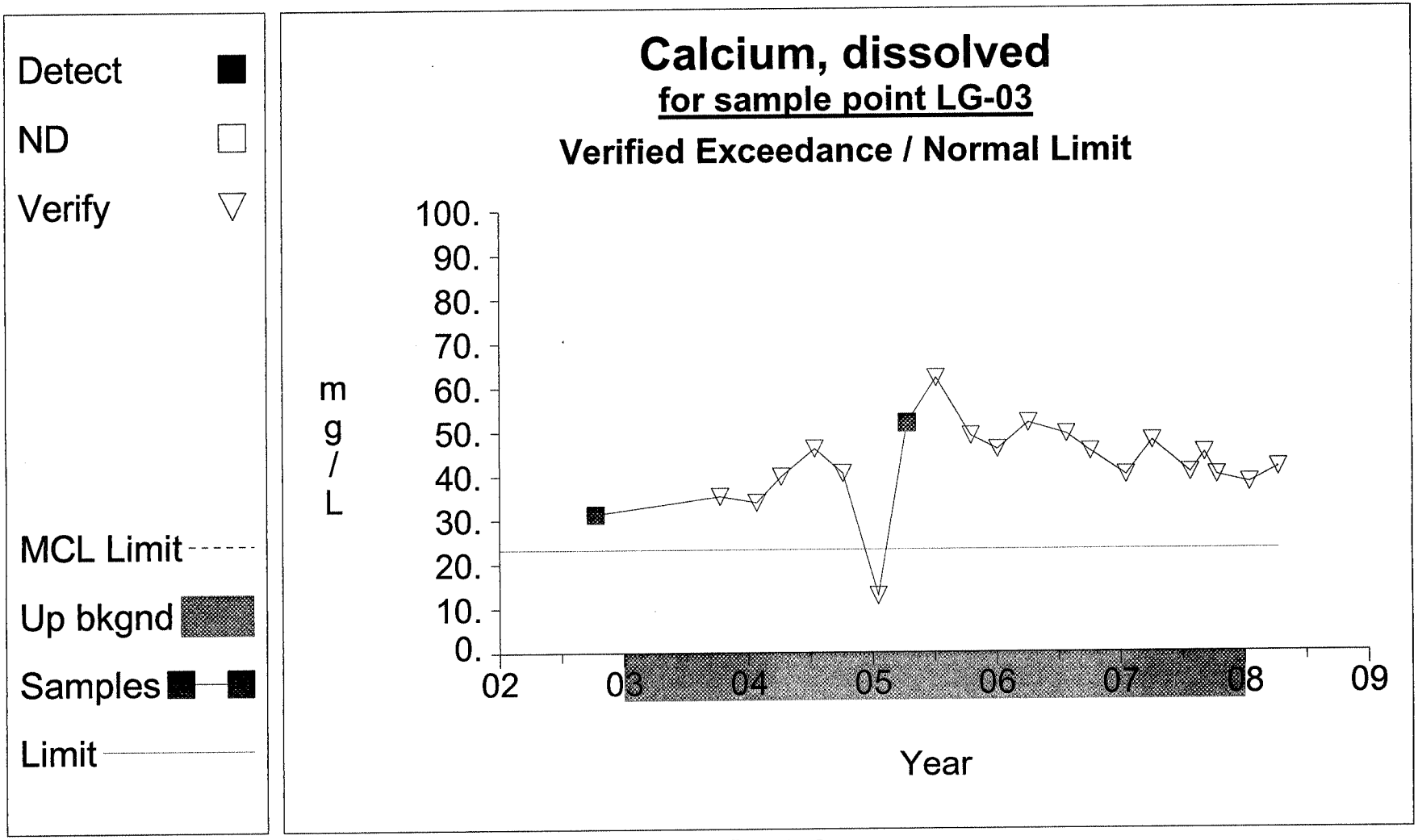
Up vs. Down Prediction Limits



Graph 26

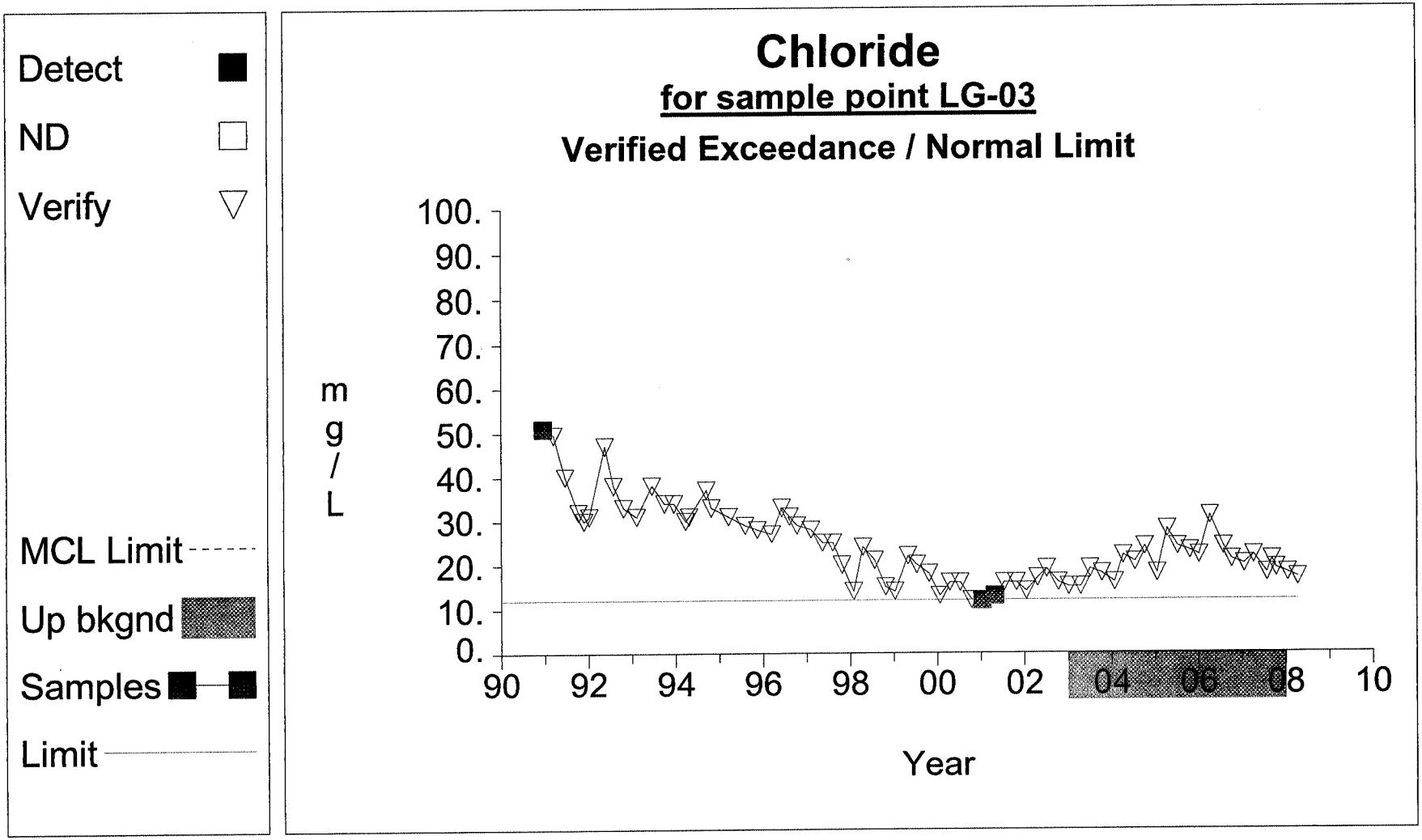
Prepared by: Snohomish County Solid Waste

Up vs. Down Prediction Limits



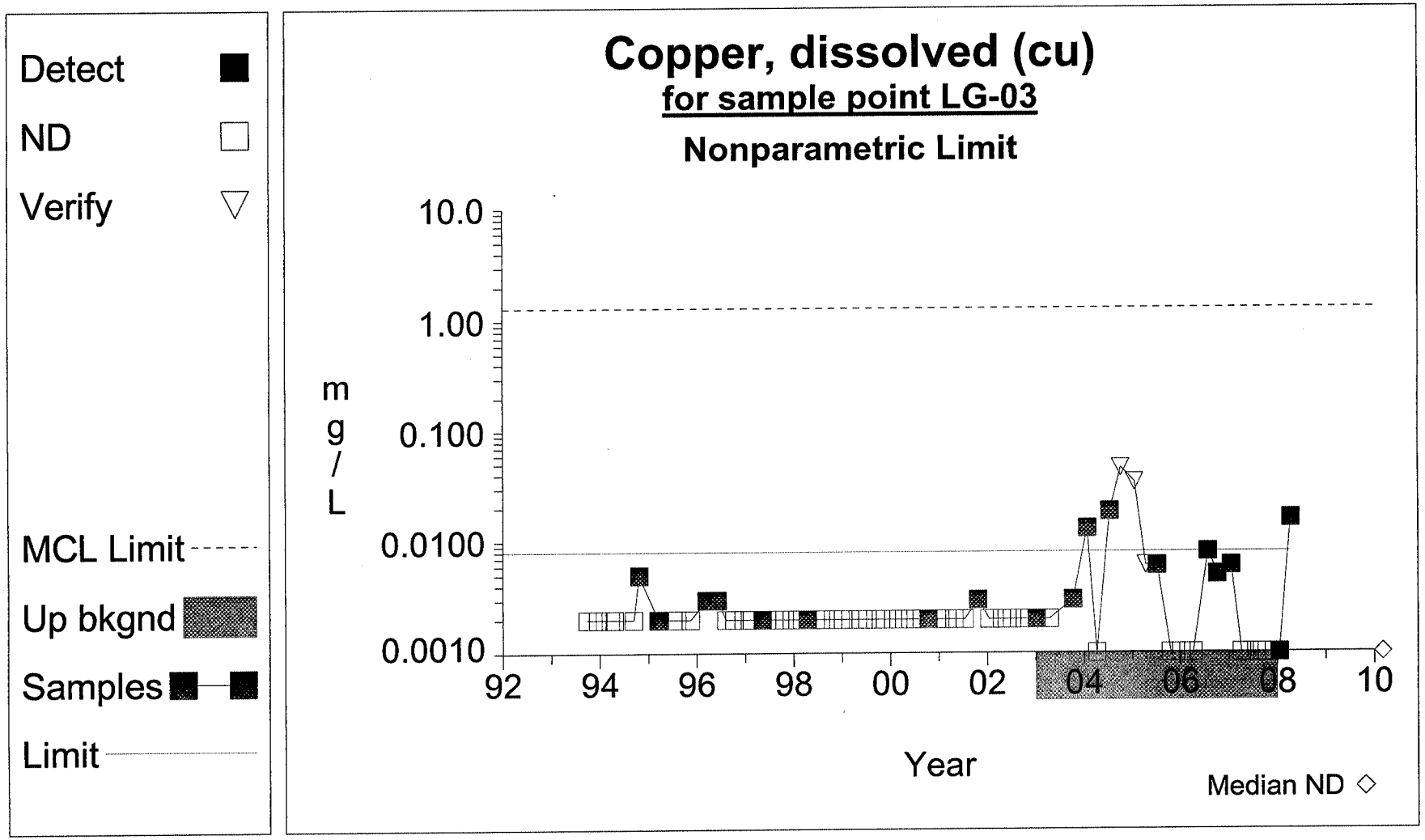
Graph 38

Up vs. Down Prediction Limits



Graph 46

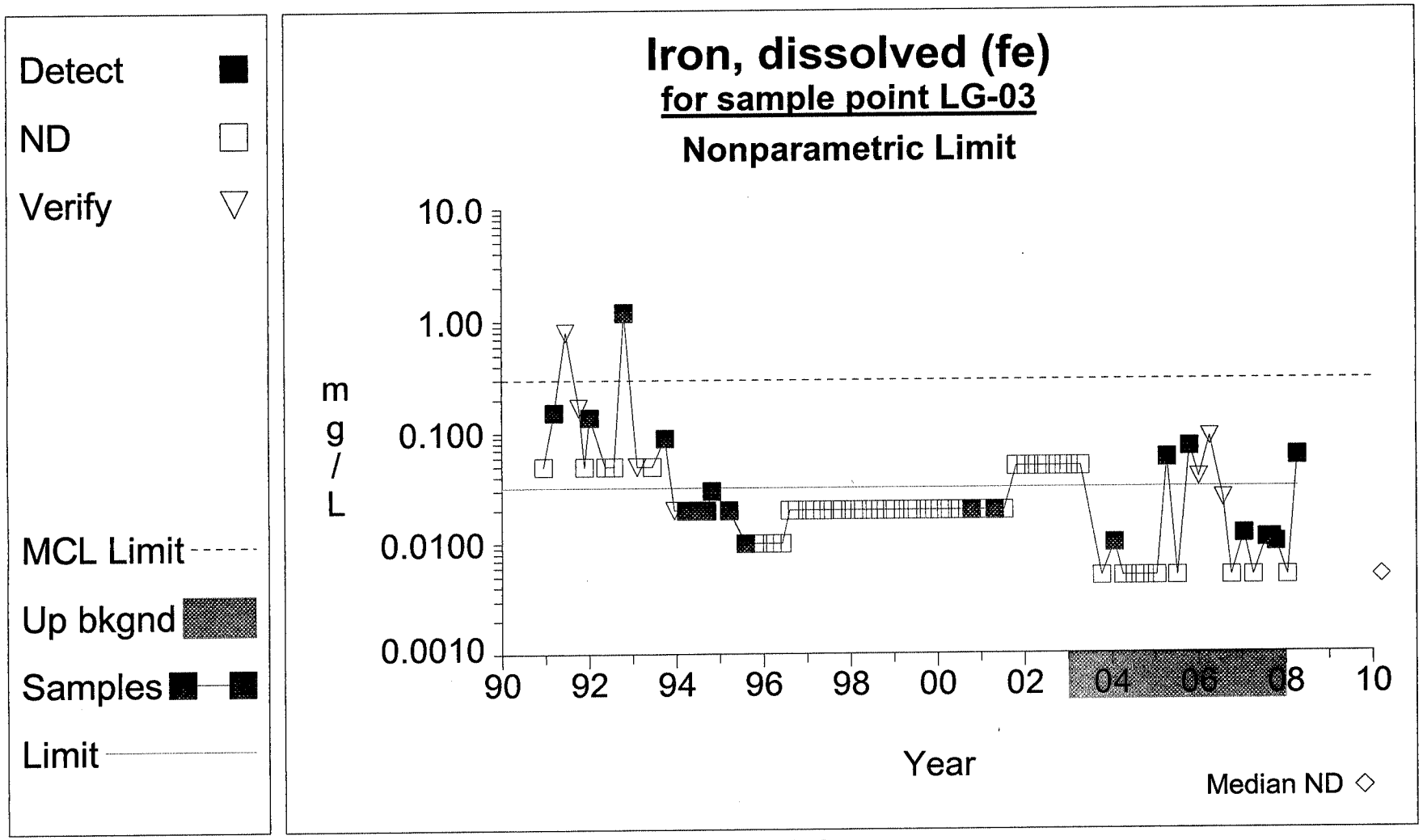
Up vs. Down Prediction Limits



Graph 62

Analysis prepared on: 1/22/2009

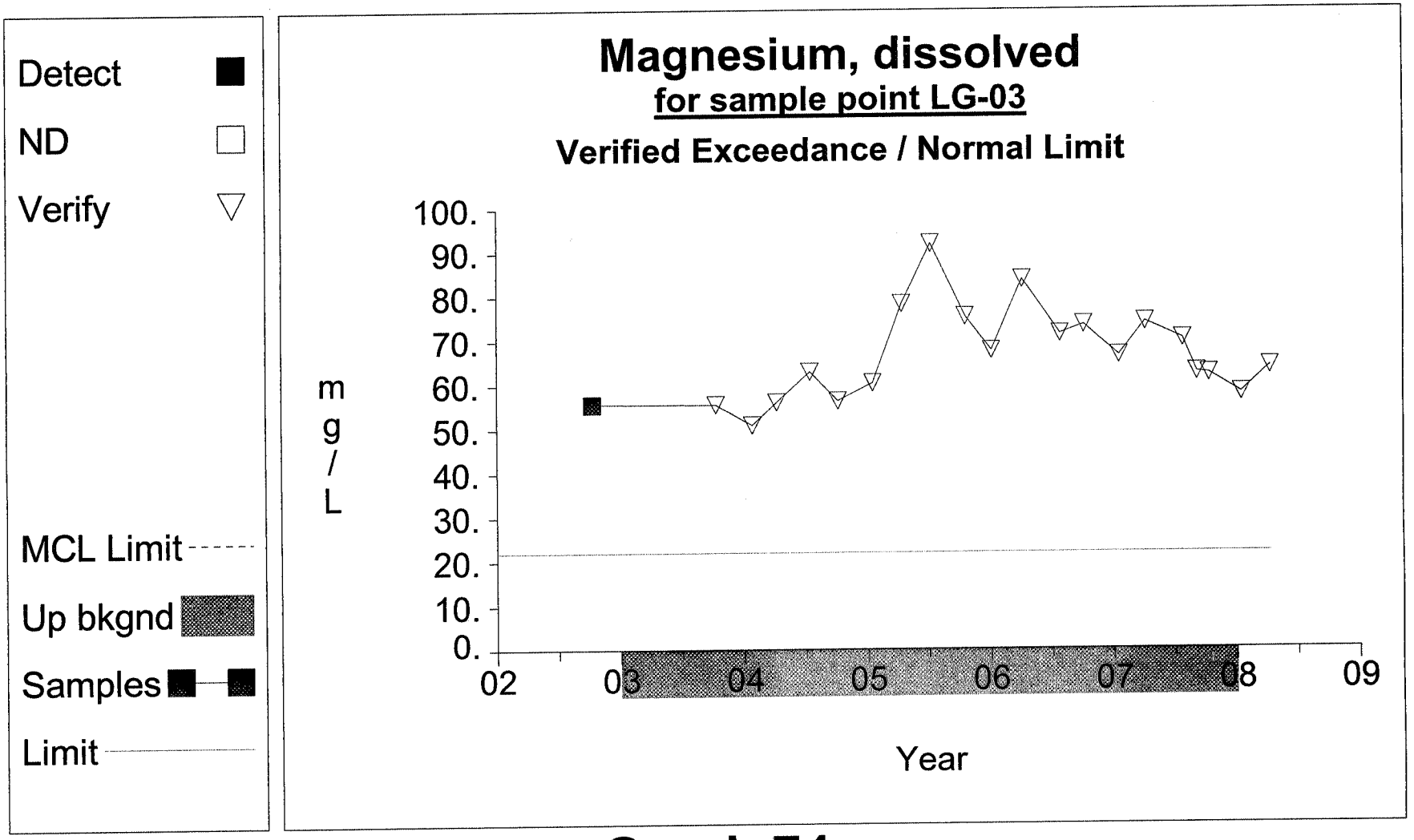
Up vs. Down Prediction Limits



Graph 66

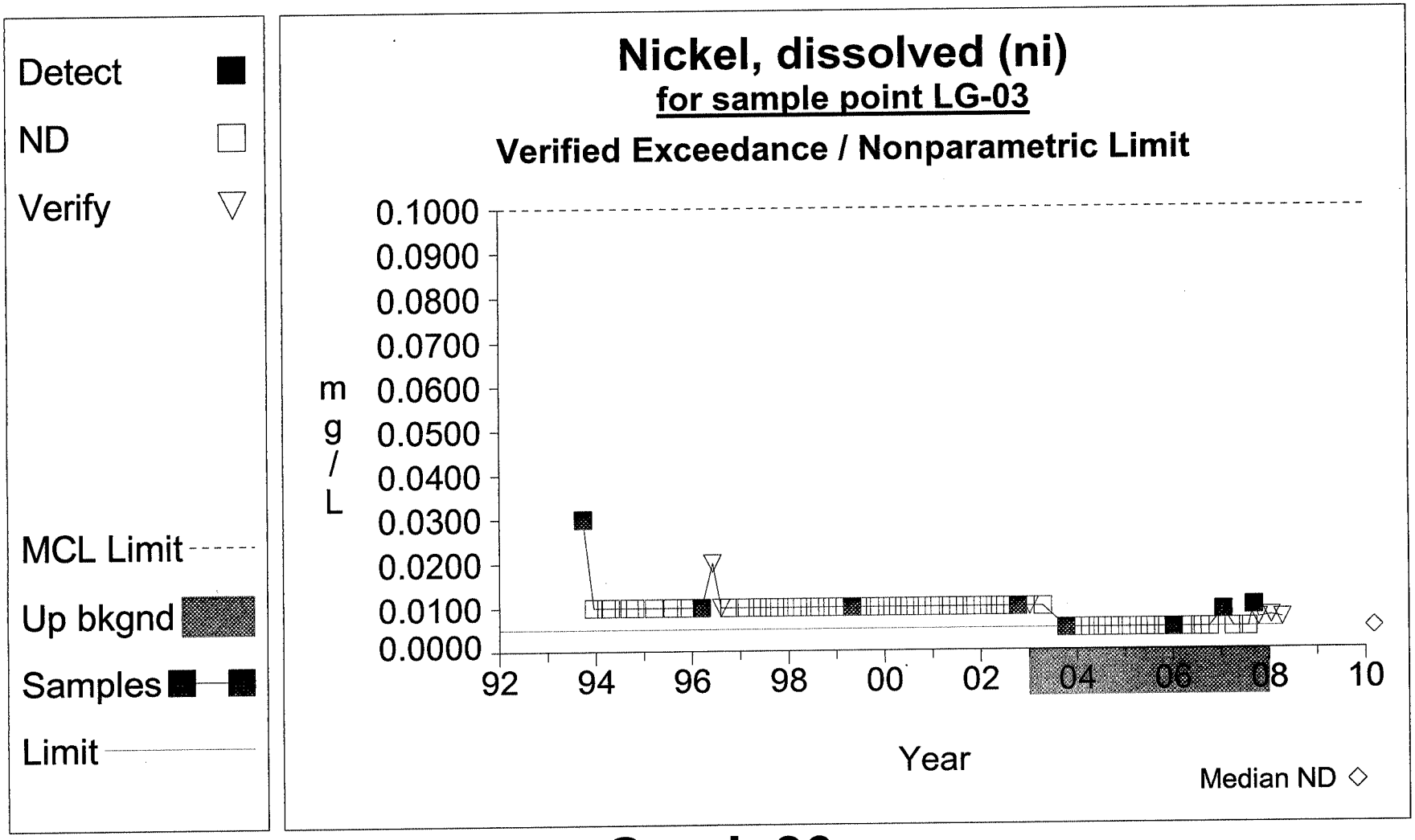
Prepared by: Snohomish County Solid Waste

Up vs. Down Prediction Limits



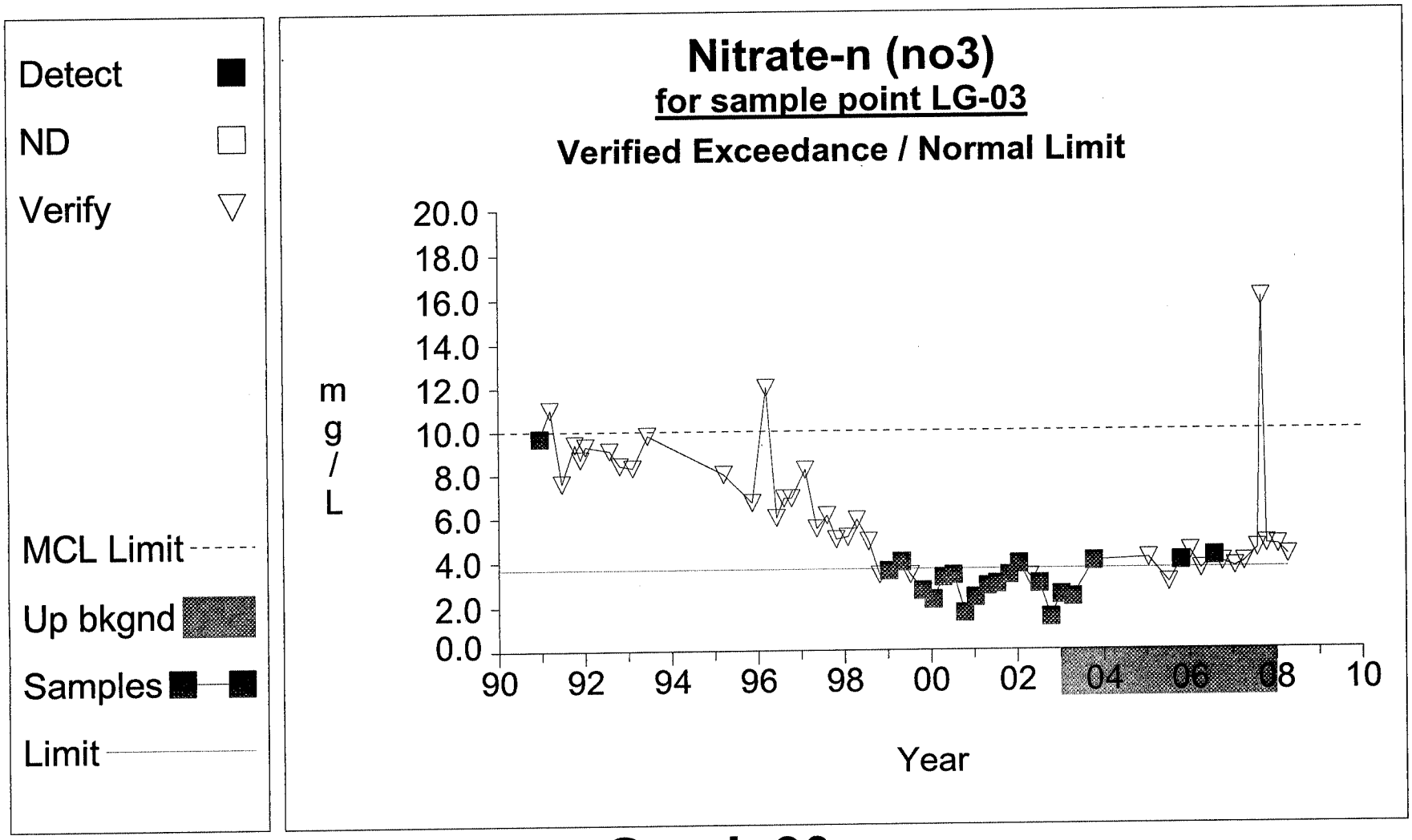
Graph 74

Up vs. Down Prediction Limits



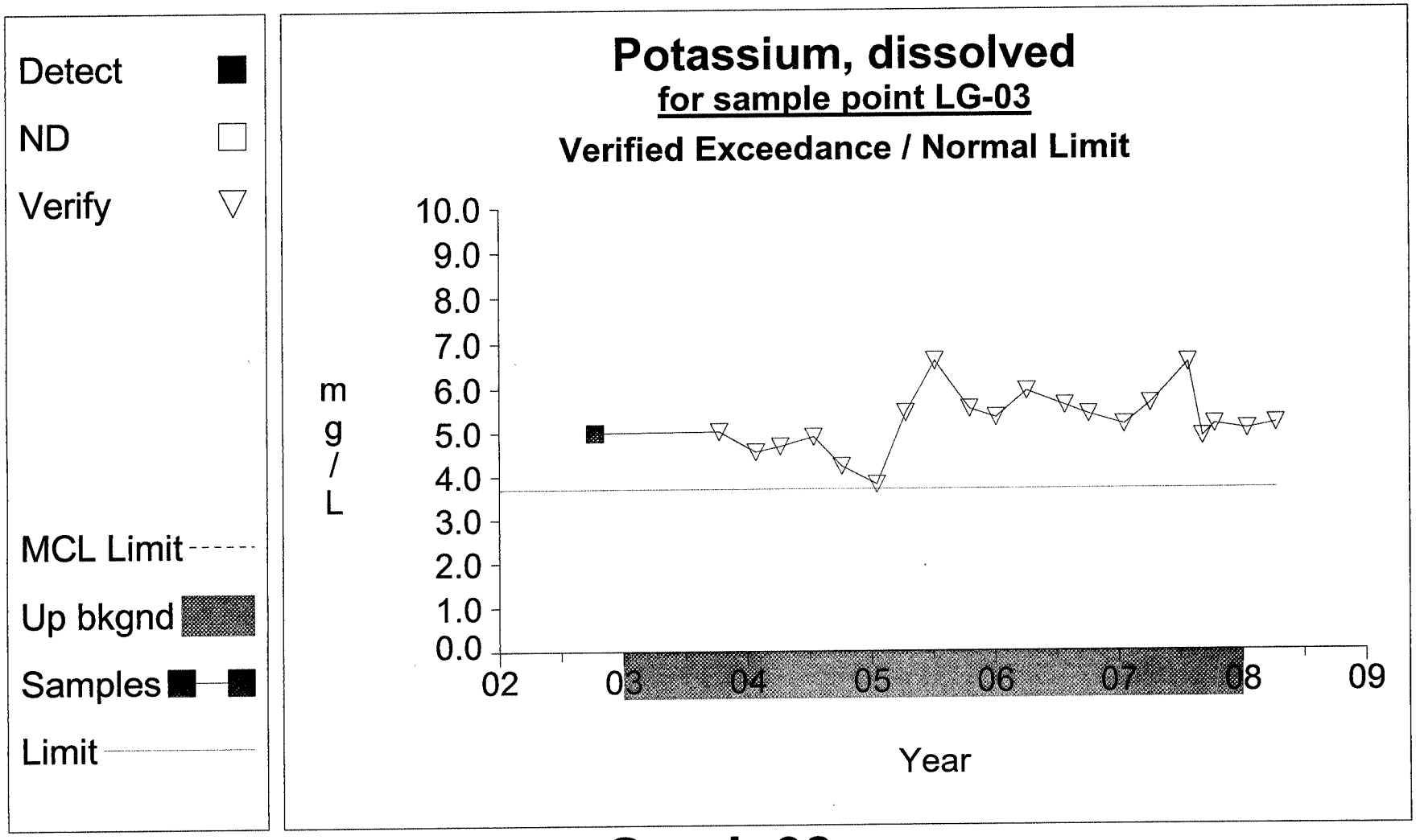
Graph 86

Up vs. Down Prediction Limits



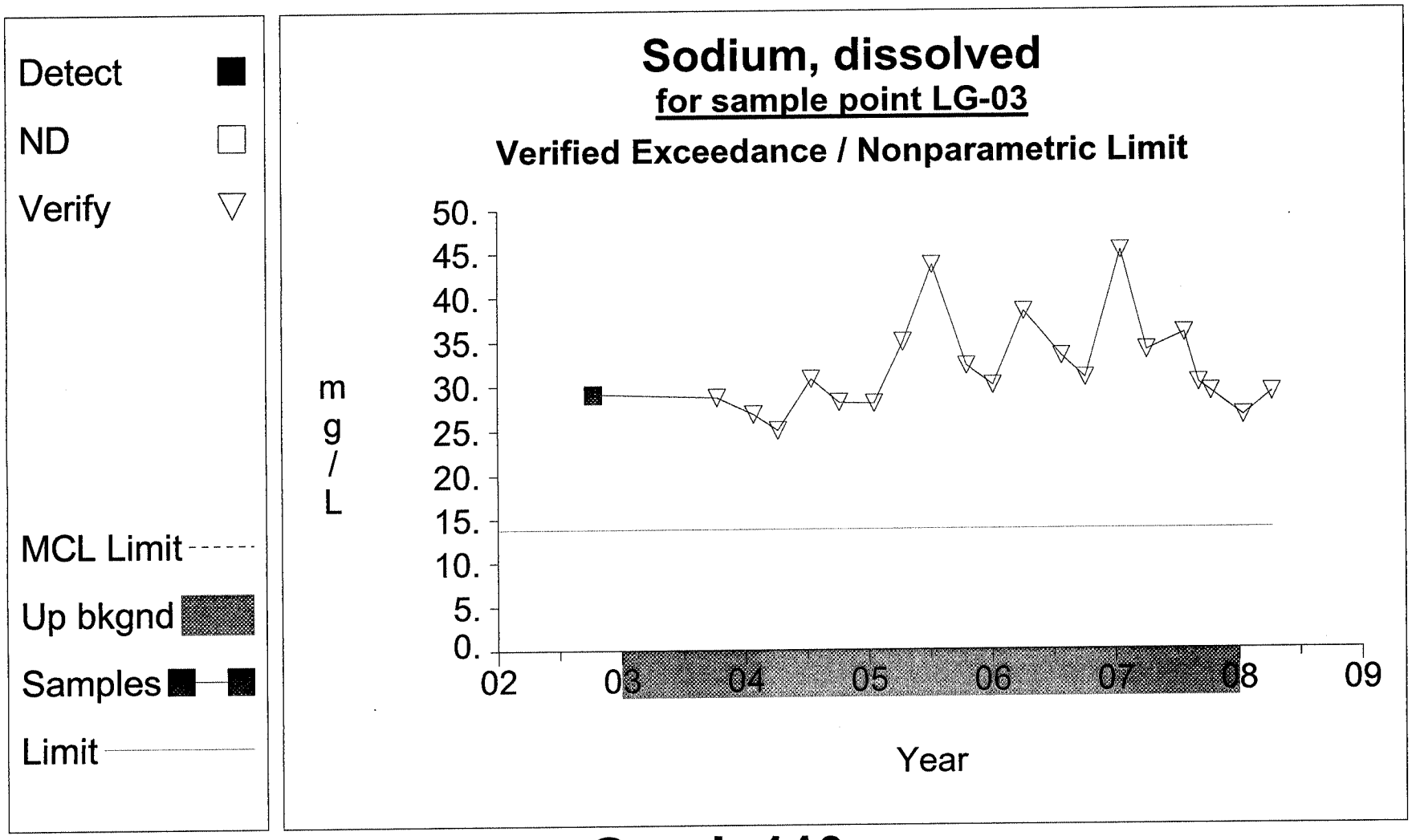
Graph 90

Up vs. Down Prediction Limits



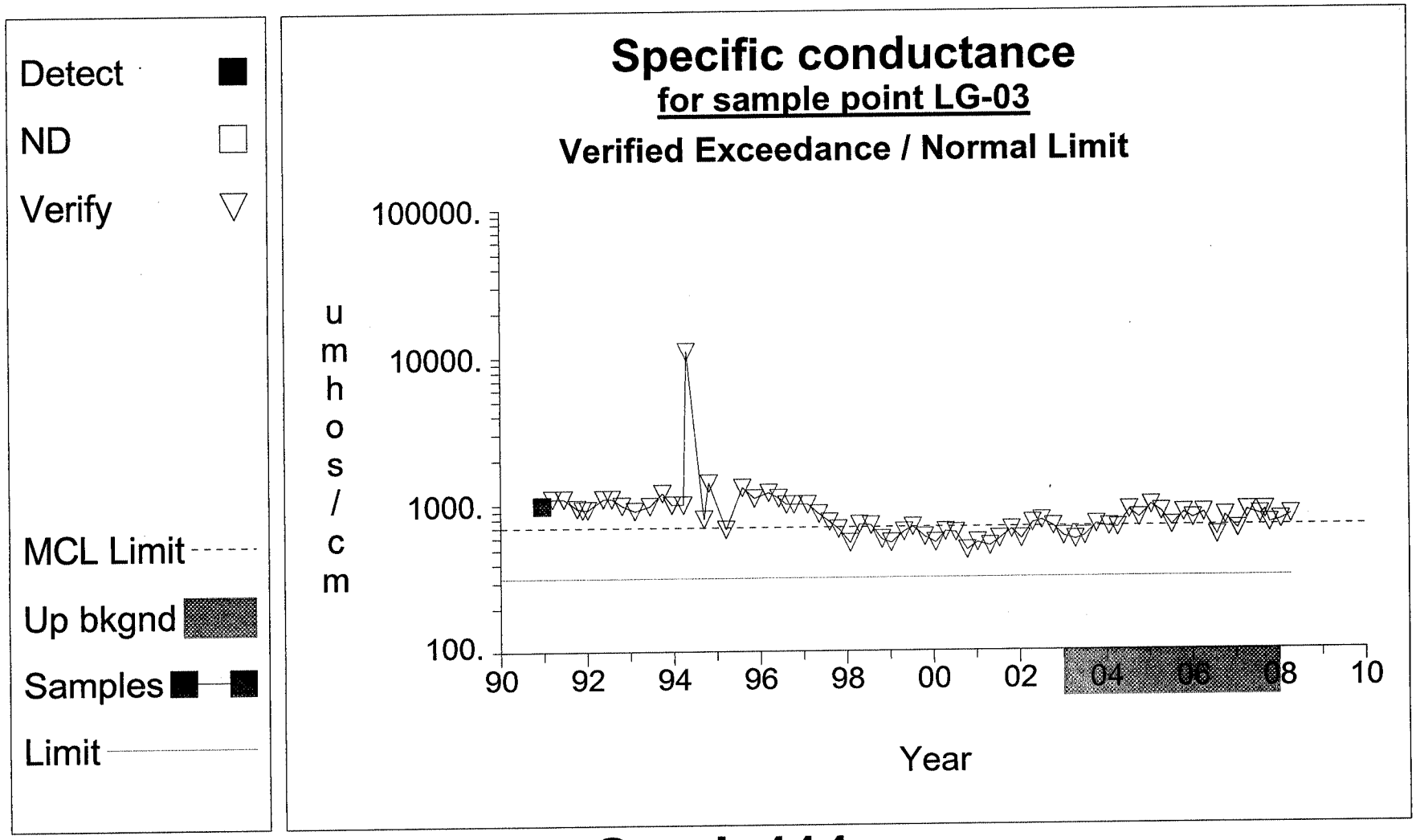
Graph 98

Up vs. Down Prediction Limits



Graph 110

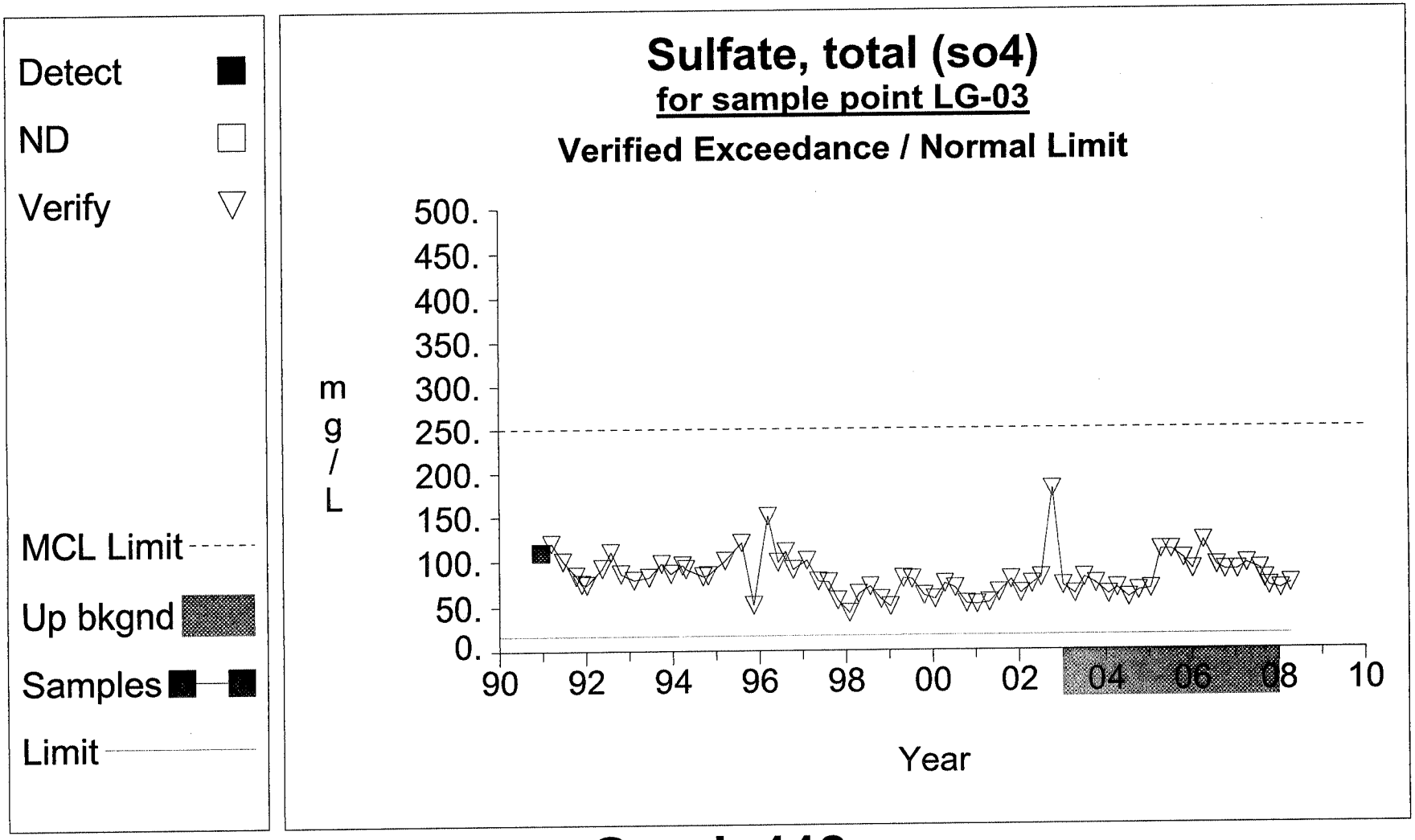
Up vs. Down Prediction Limits



Graph 114

Analysis prepared on: 1/22/2009

Up vs. Down Prediction Limits

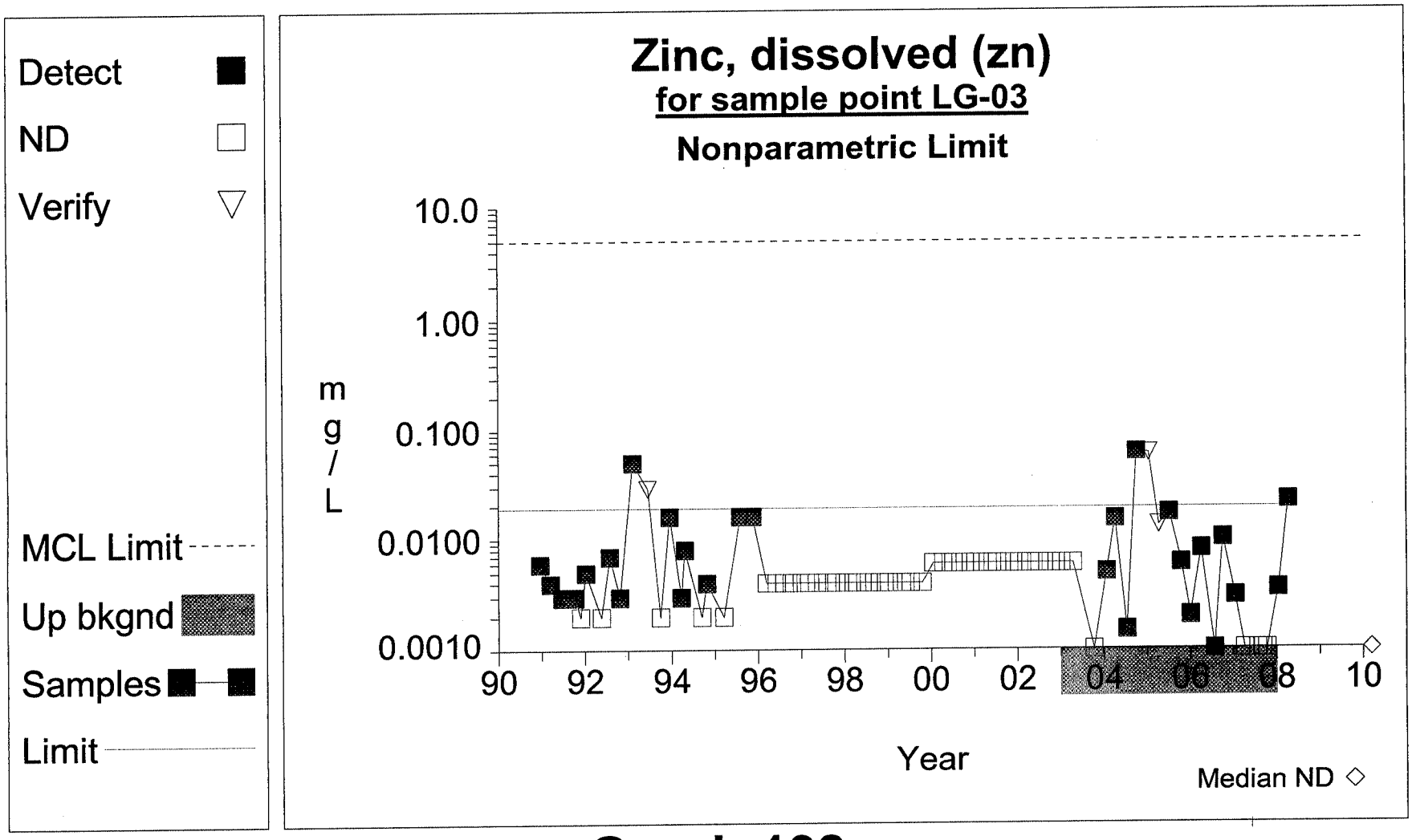


Graph 118

Prepared by: Snohomish County Solid Waste

Analysis prepared on: 1/22/2009

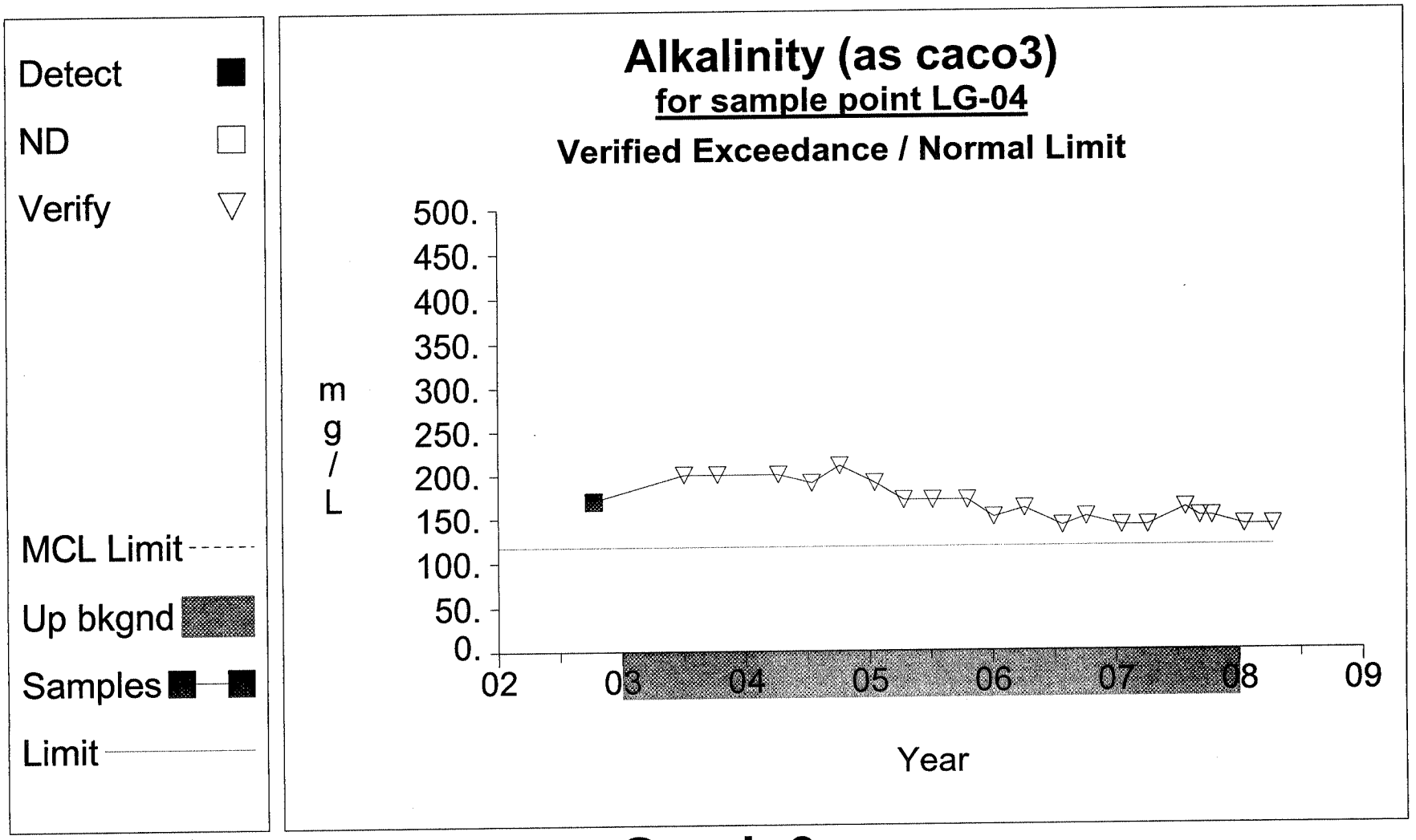
Up vs. Down Prediction Limits



Graph 138

Prepared by: Snohomish County Solid Waste

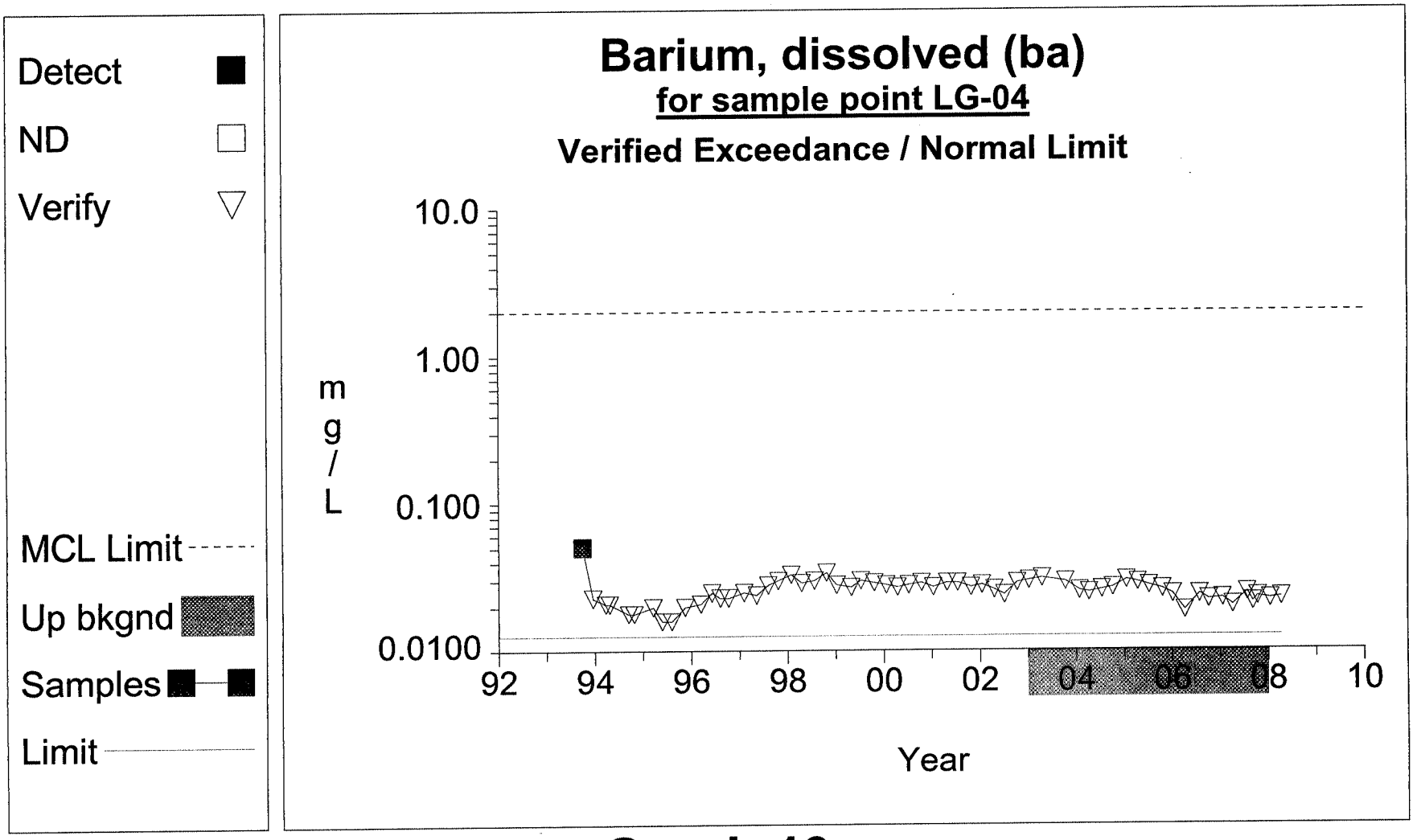
Up vs. Down Prediction Limits



Graph 3

Analysis prepared on: 1/22/2009

Up vs. Down Prediction Limits

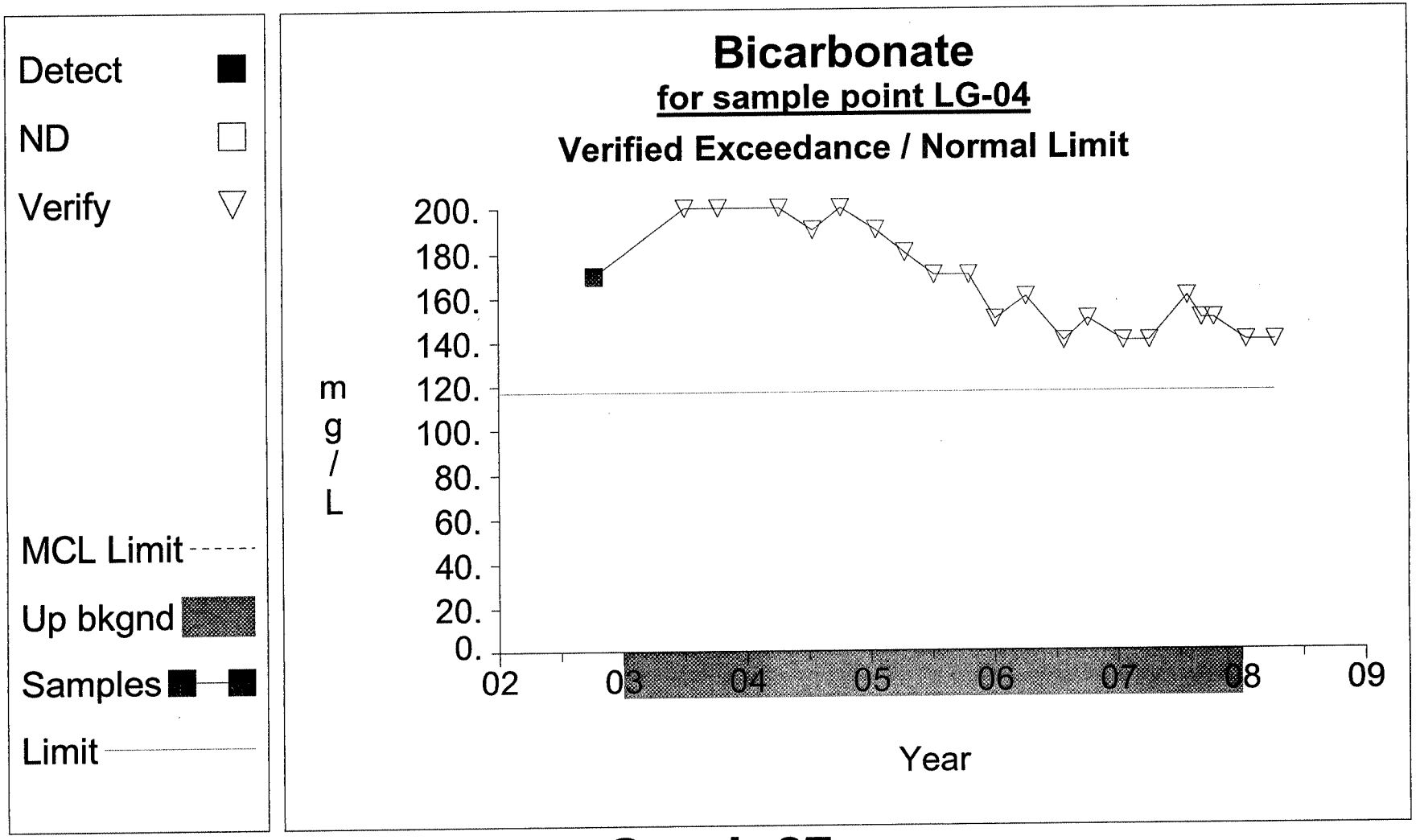


Graph 19

Prepared by: Snohomish County Solid Waste

Analysis prepared on: 1/22/2009

Up vs. Down Prediction Limits

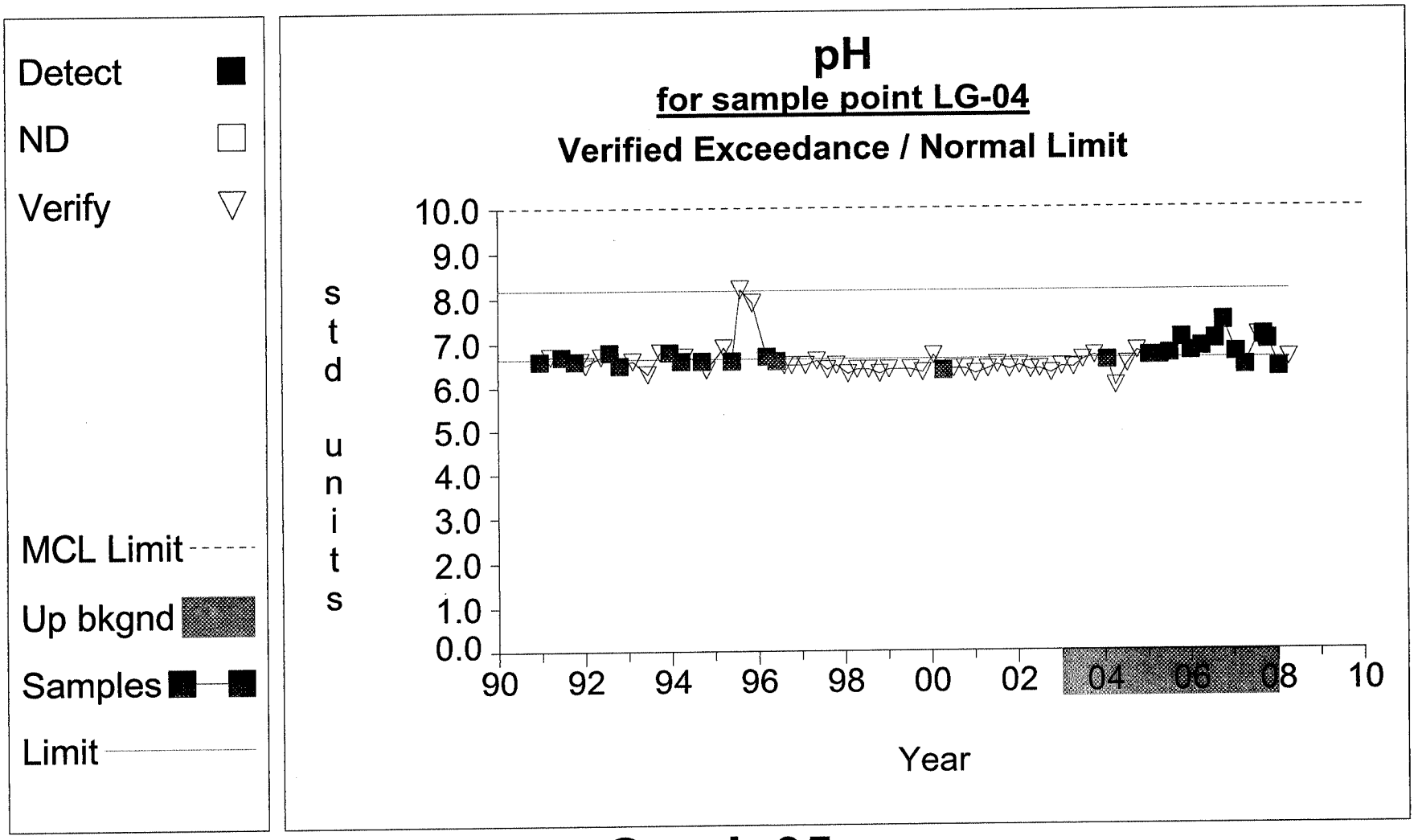


Graph 27

Prepared by: Snohomish County Solid Waste

Analysis prepared on: 1/22/2009

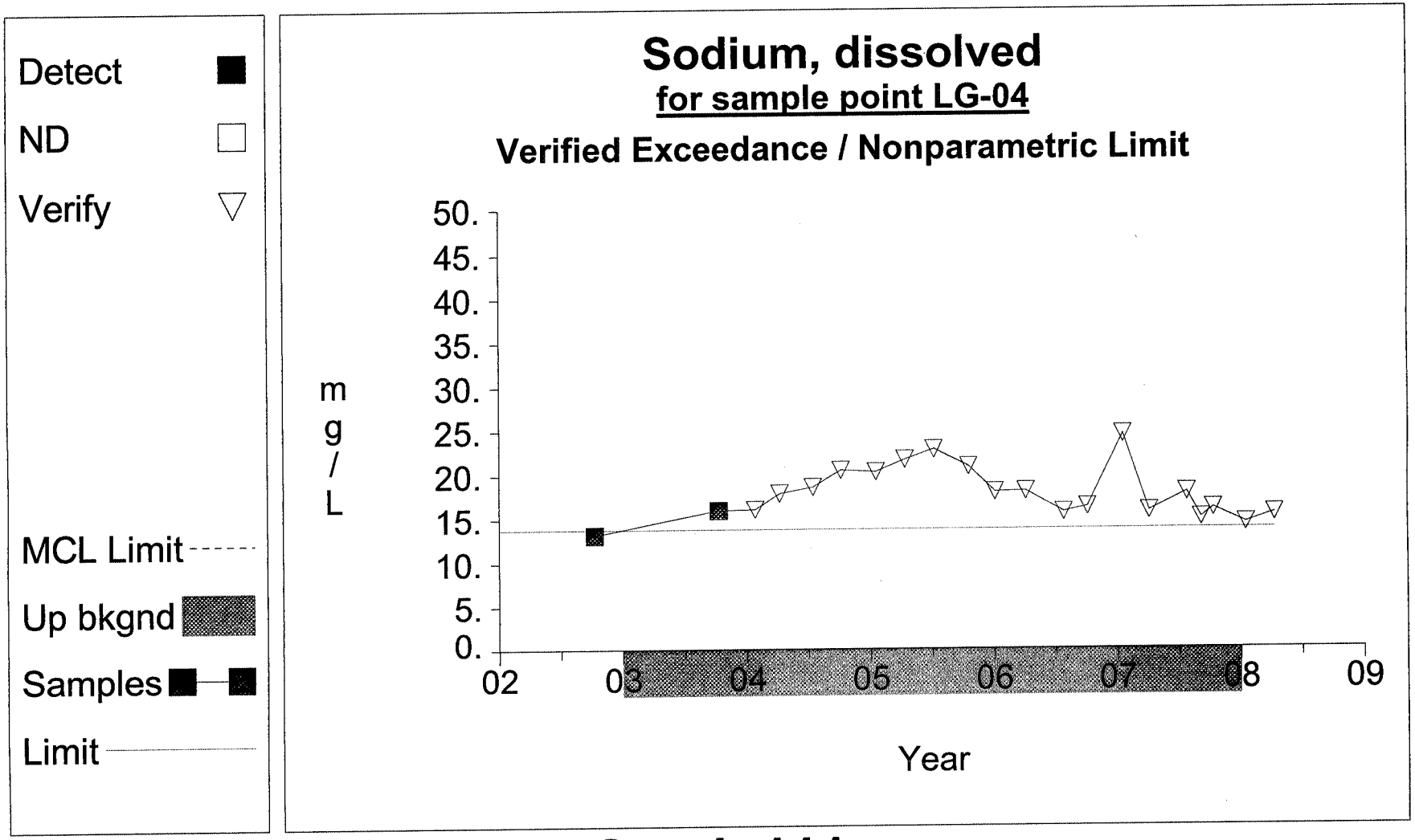
Up vs. Down Prediction Limits



Graph 95

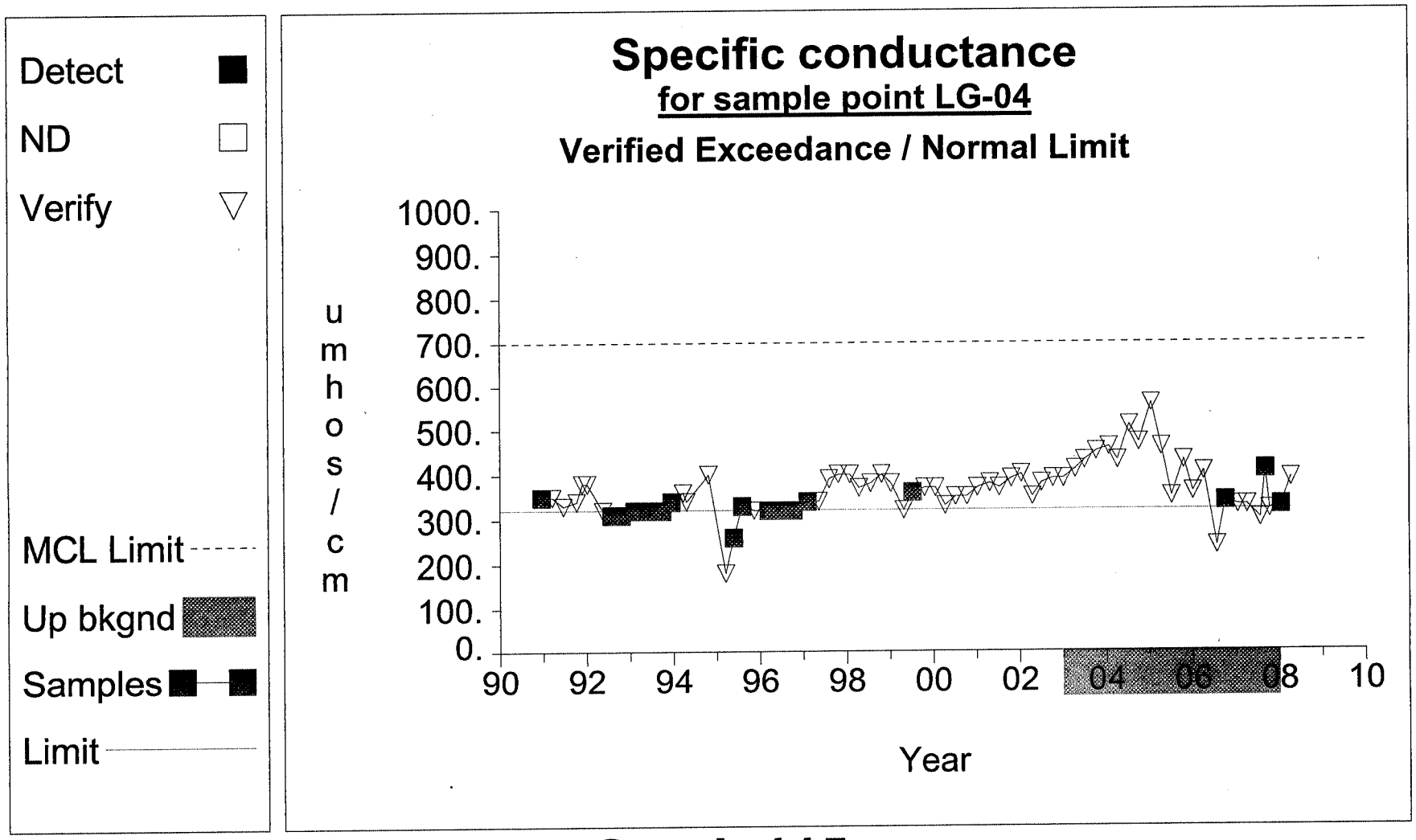
Prepared by: Snohomish County Solid Waste

Up vs. Down Prediction Limits



Graph 111

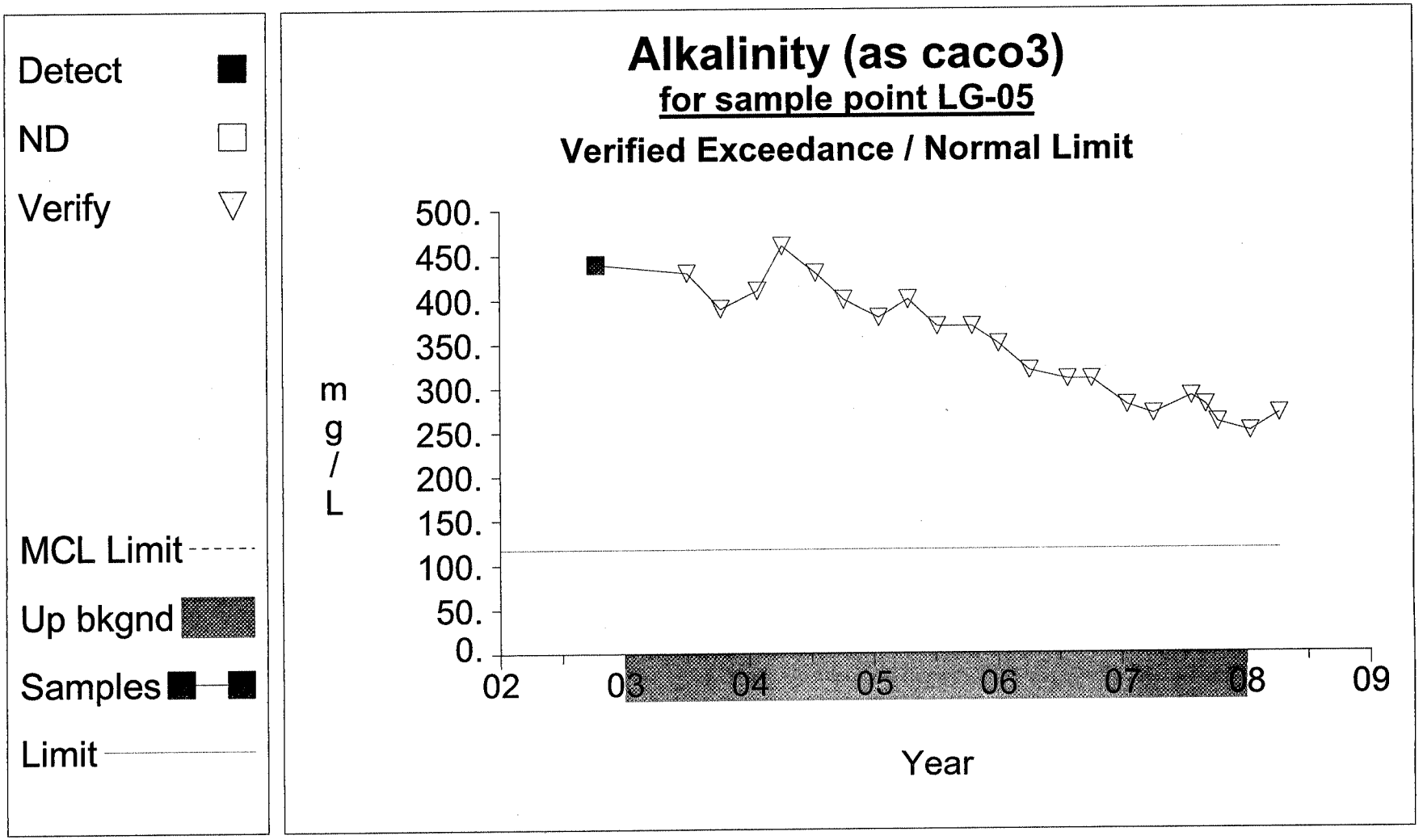
Up vs. Down Prediction Limits



Graph 115

Analysis prepared on: 1/22/2009

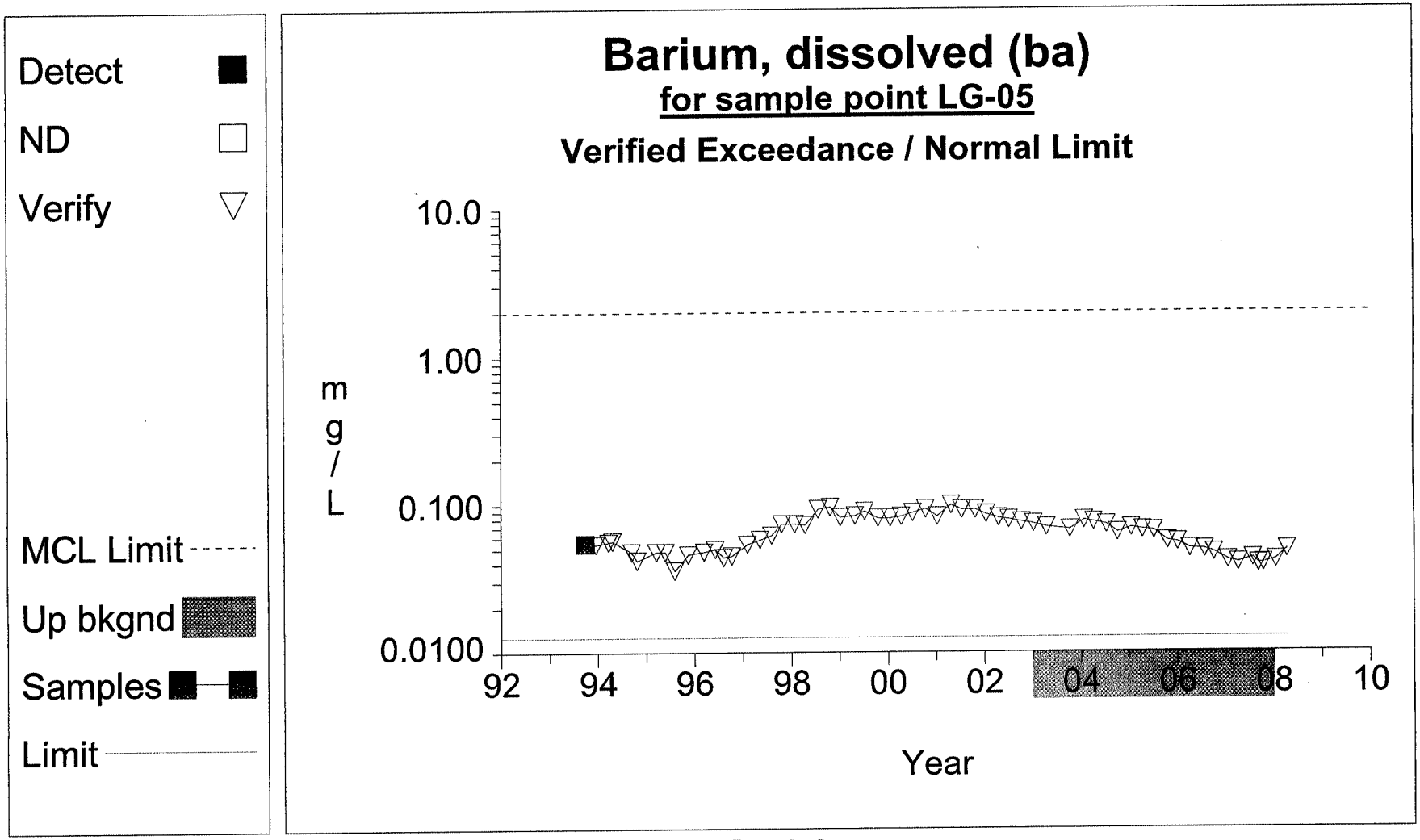
Up vs. Down Prediction Limits



Graph 4

Prepared by: Snohomish County Solid Waste

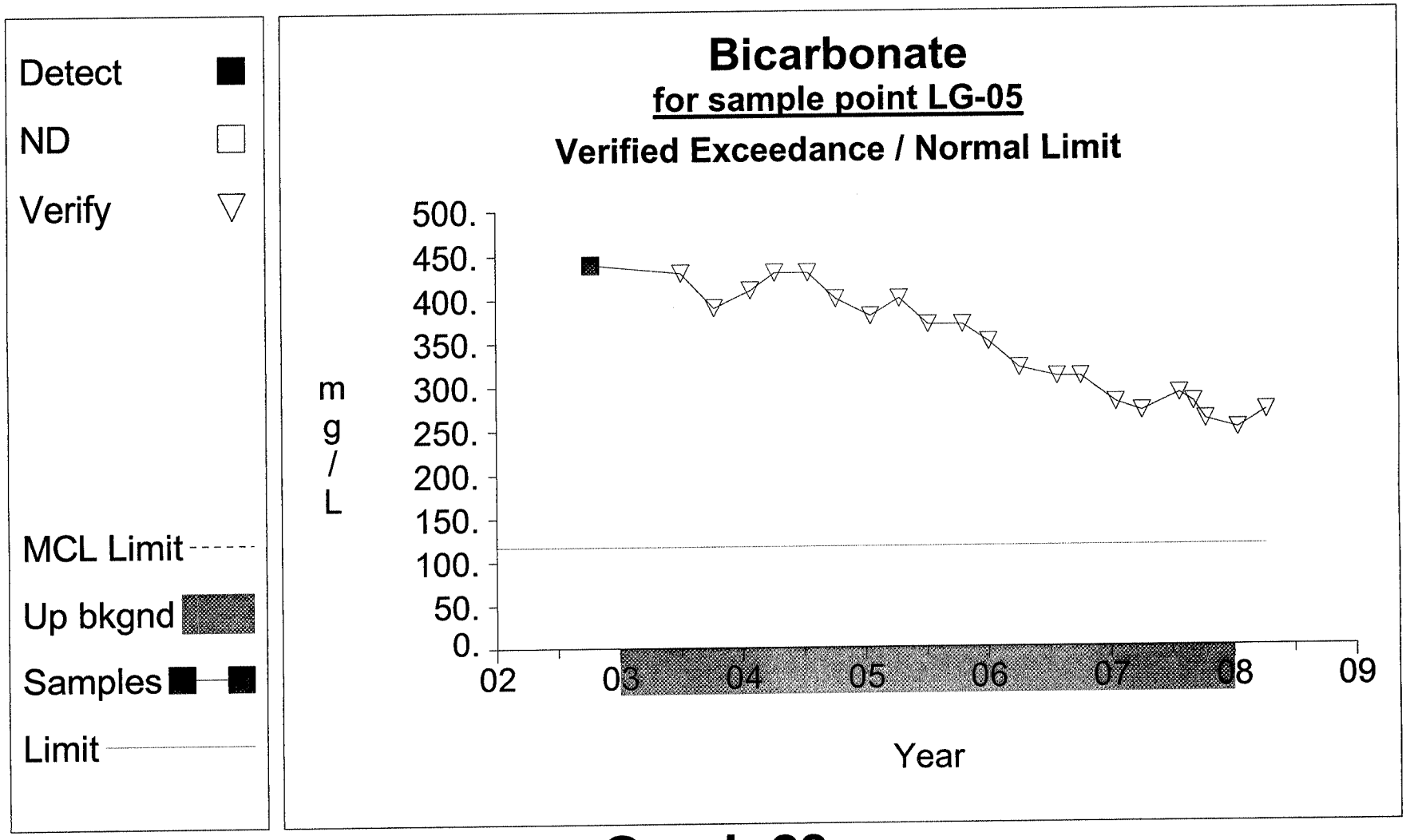
Up vs. Down Prediction Limits



Graph 20

Analysis prepared on: 1/22/2009

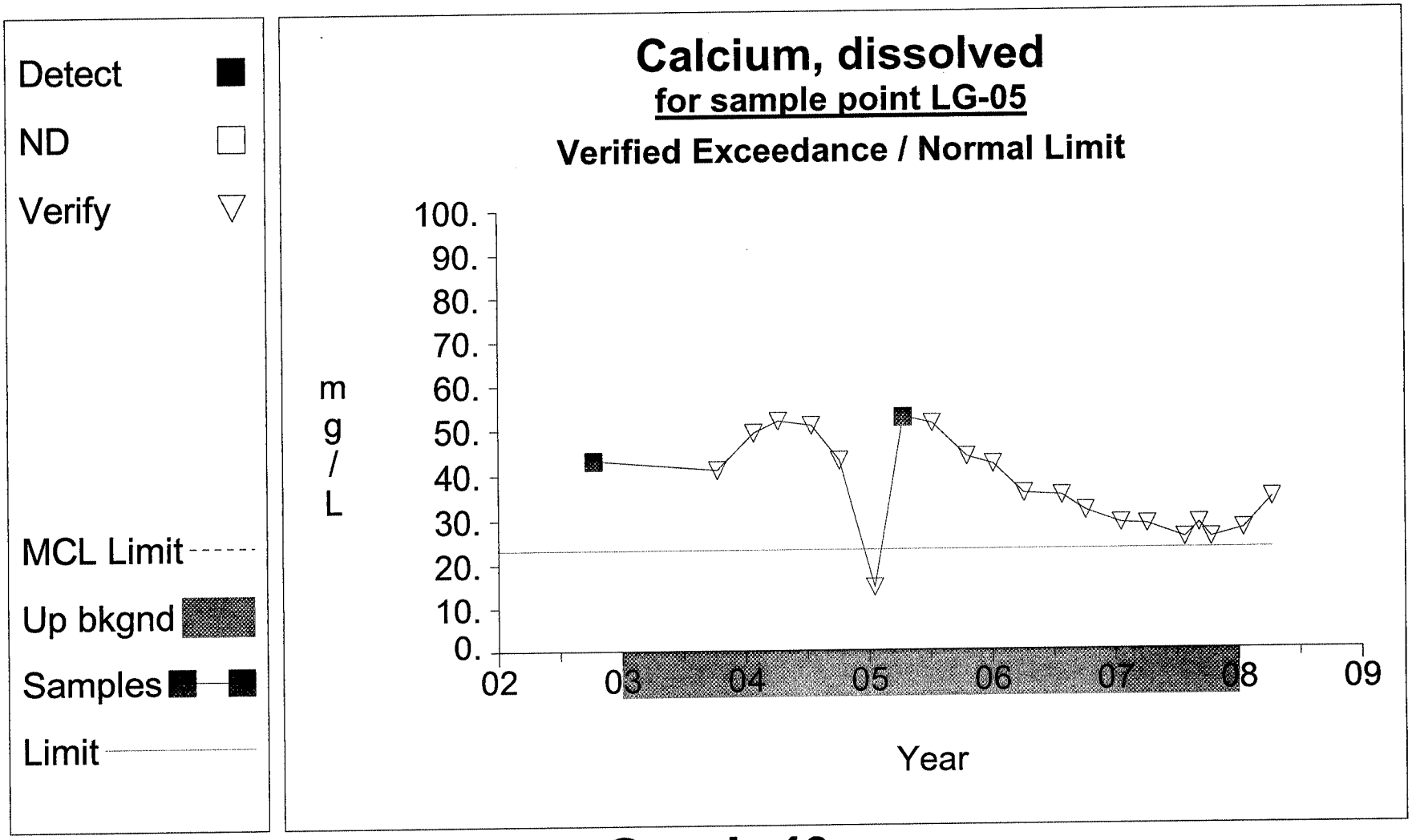
Up vs. Down Prediction Limits



Graph 28

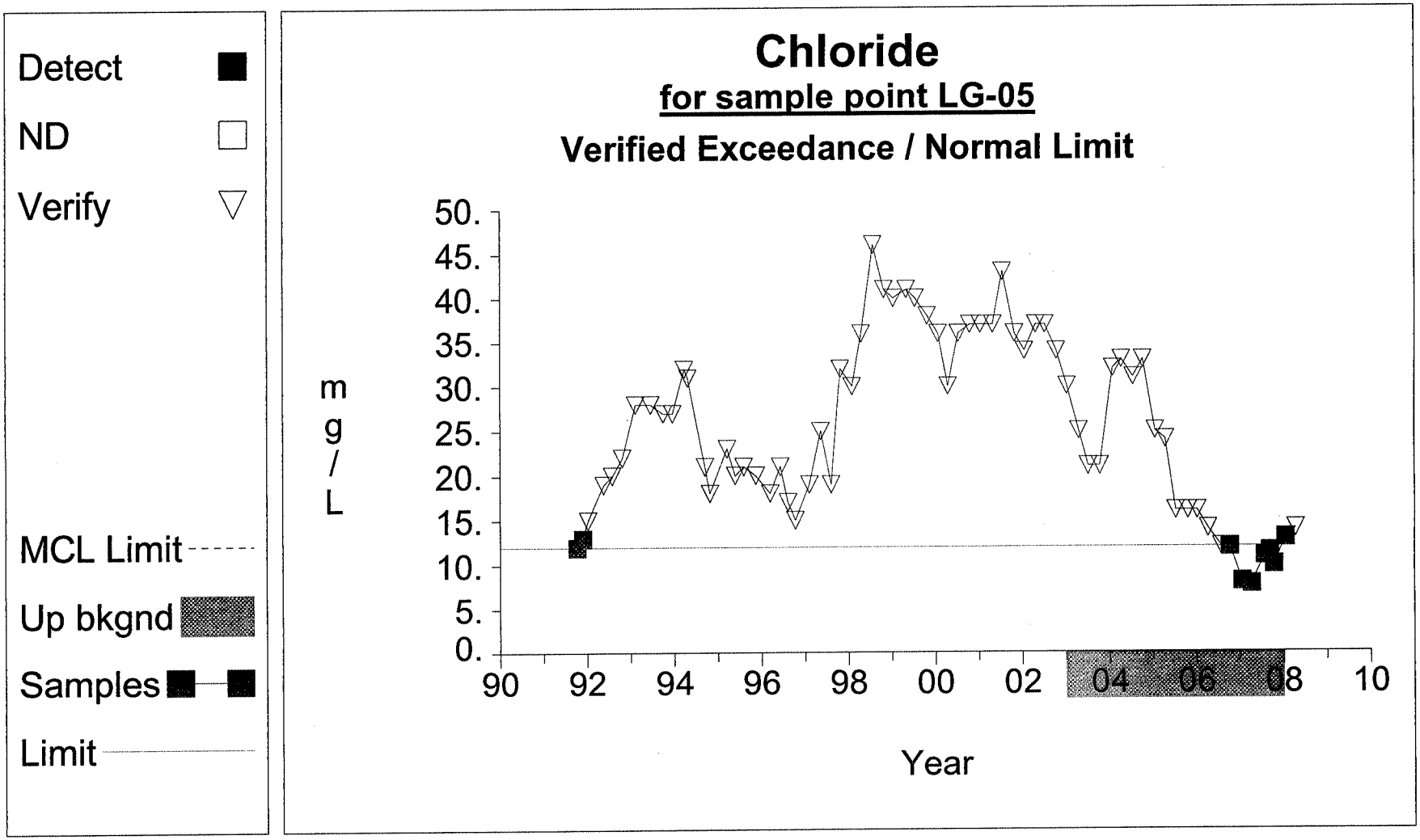
Prepared by: Snohomish County Solid Waste

Up vs. Down Prediction Limits



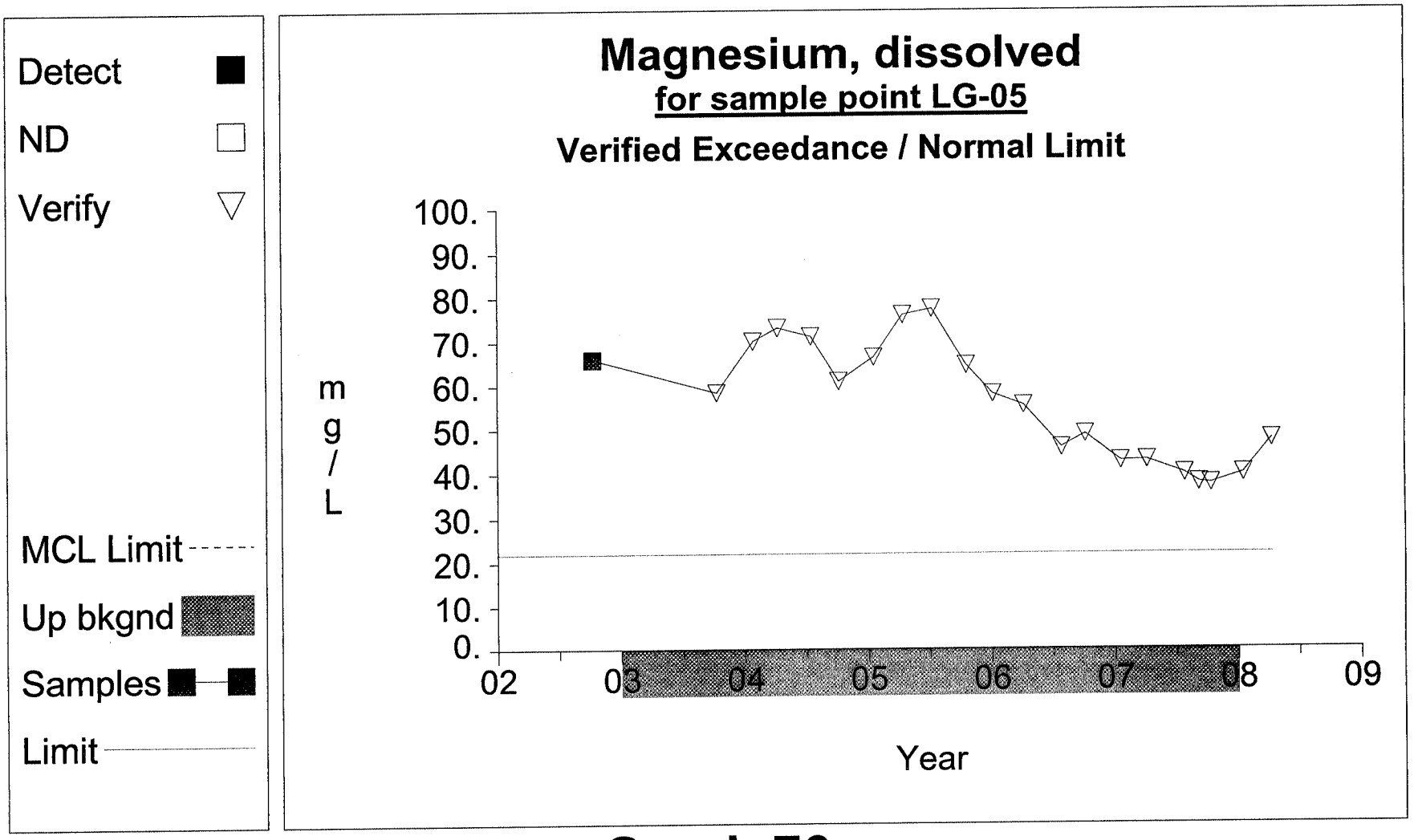
Graph 40

Up vs. Down Prediction Limits



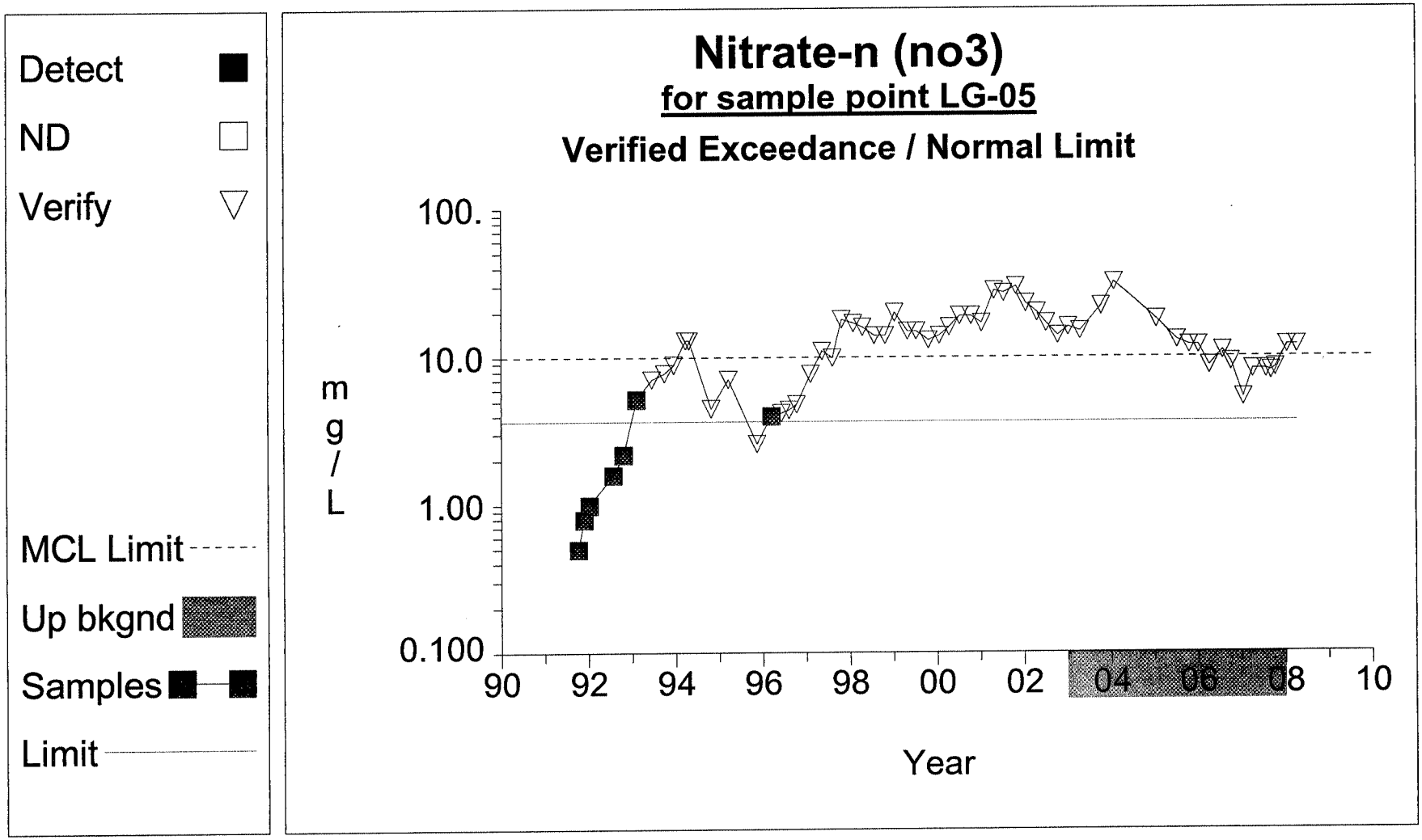
Graph 48

Up vs. Down Prediction Limits



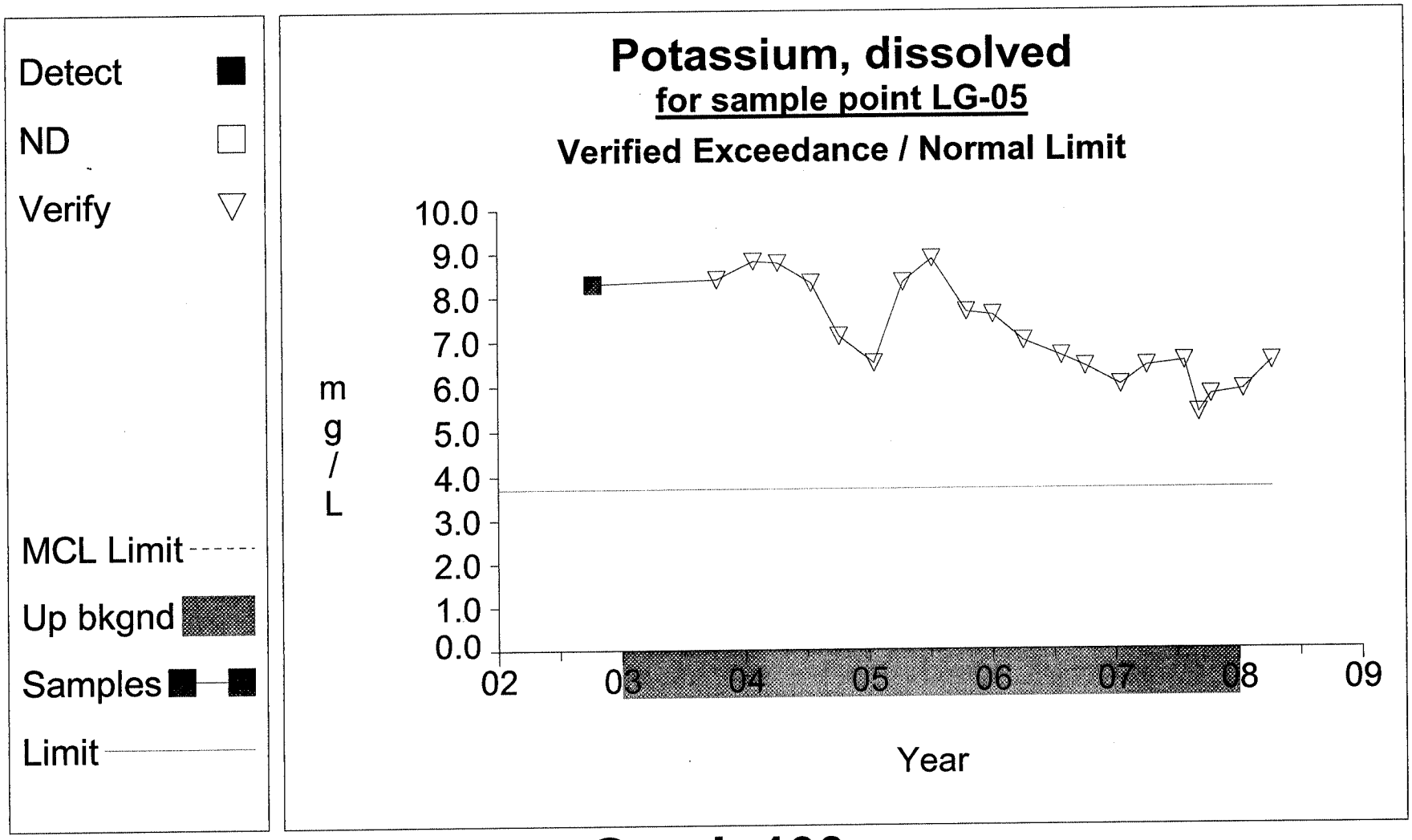
Graph 76

Up vs. Down Prediction Limits



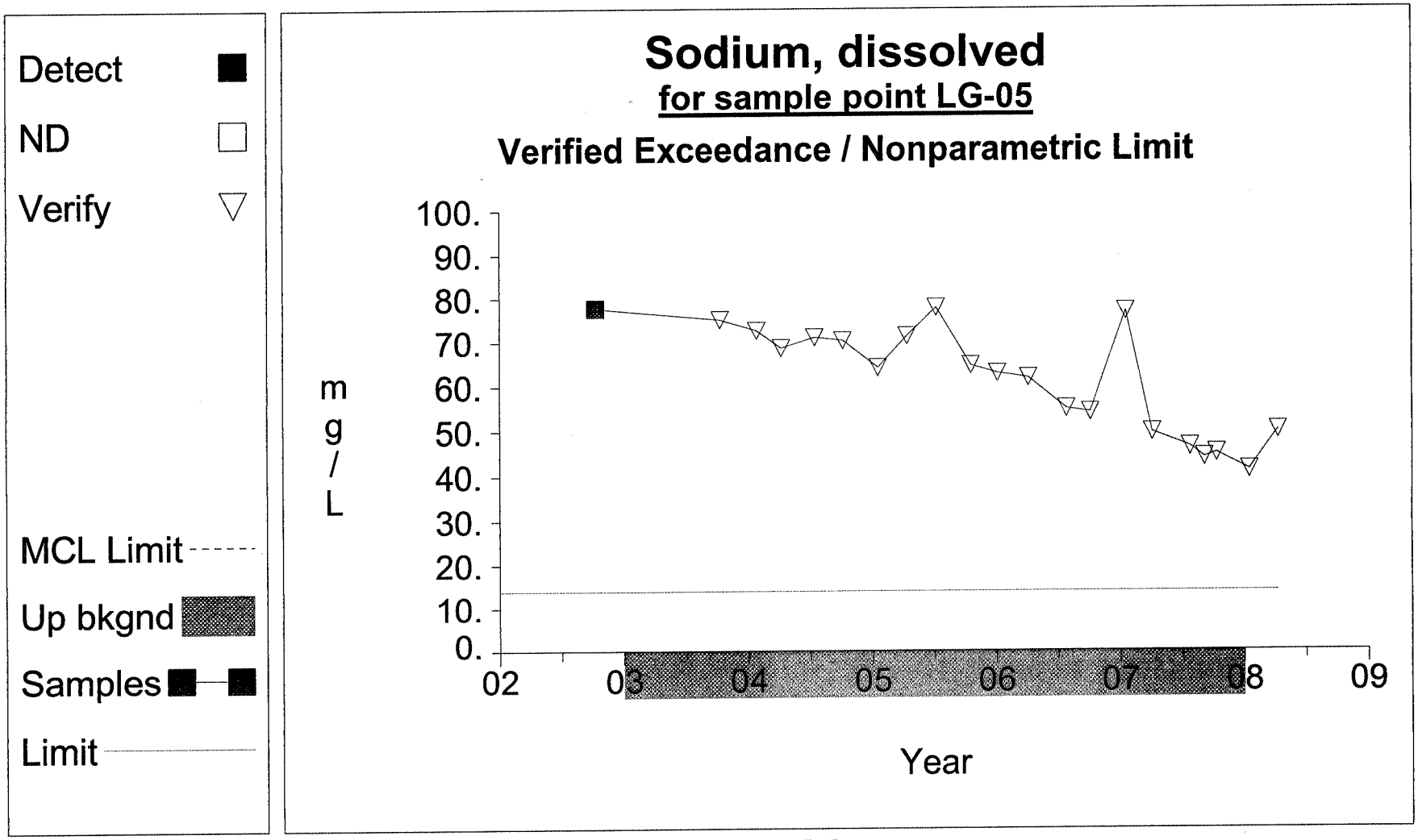
Graph 92

Up vs. Down Prediction Limits



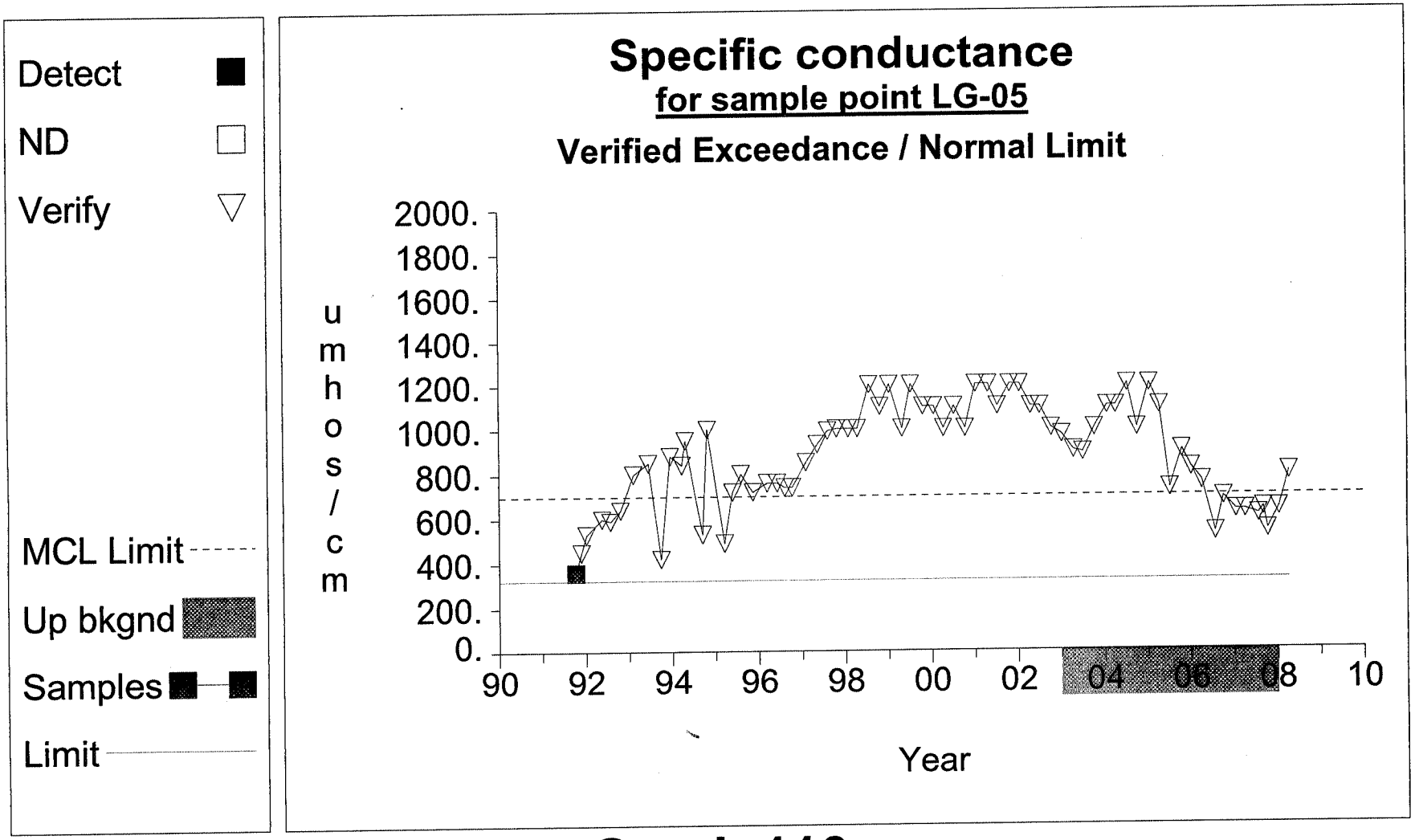
Graph 100

Up vs. Down Prediction Limits



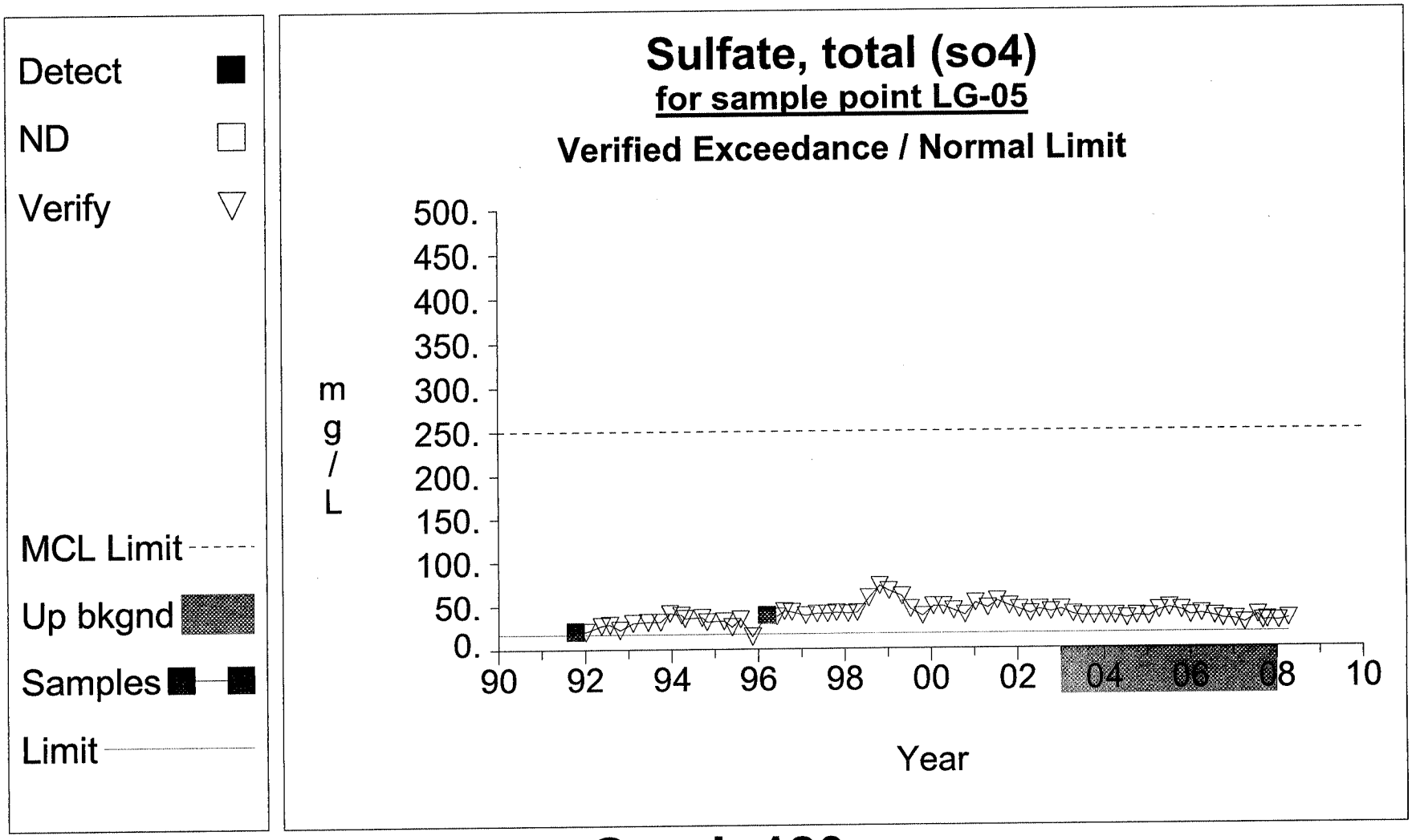
Graph 112

Up vs. Down Prediction Limits



Graph 116

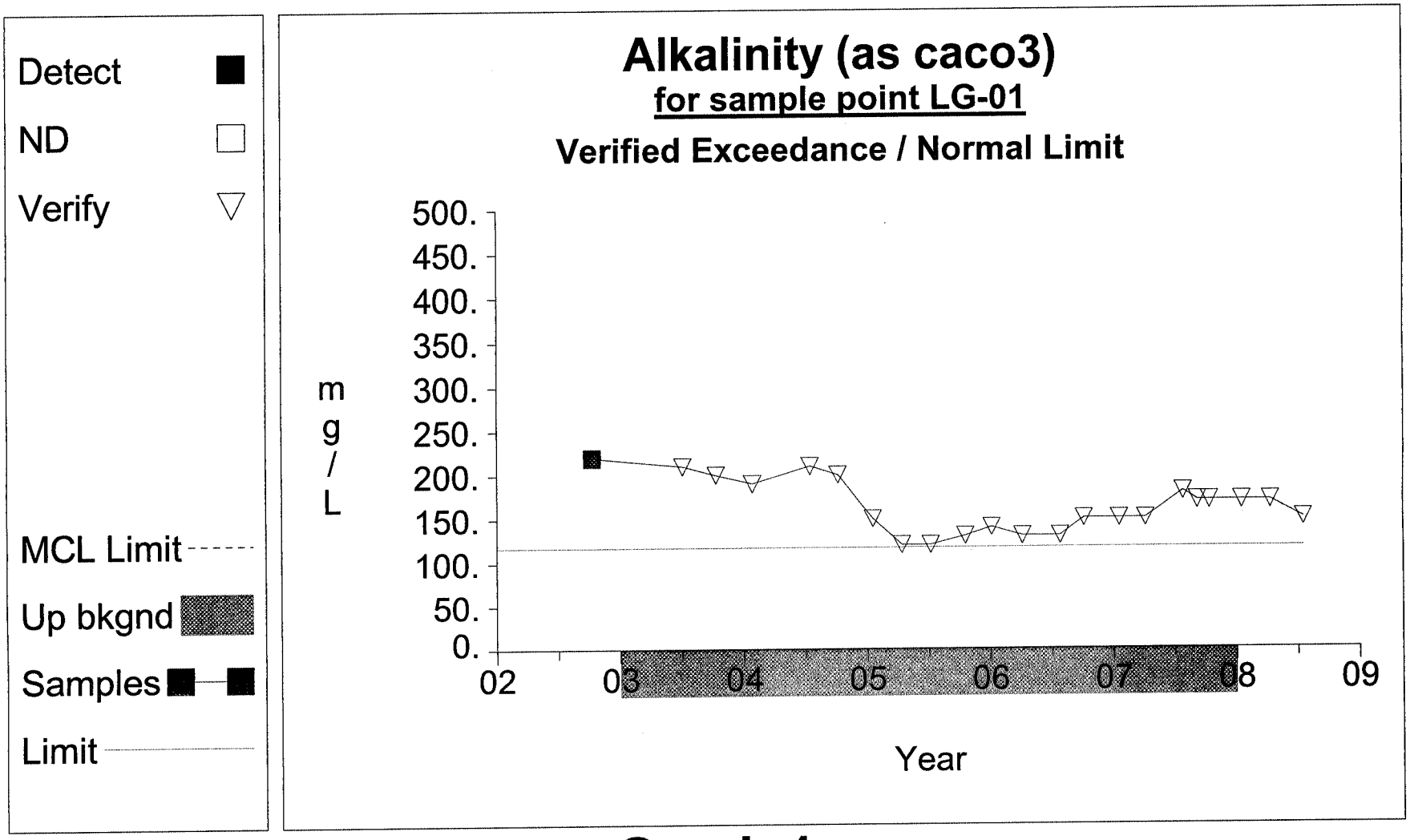
Up vs. Down Prediction Limits



Graph 120

3RD QUARTER

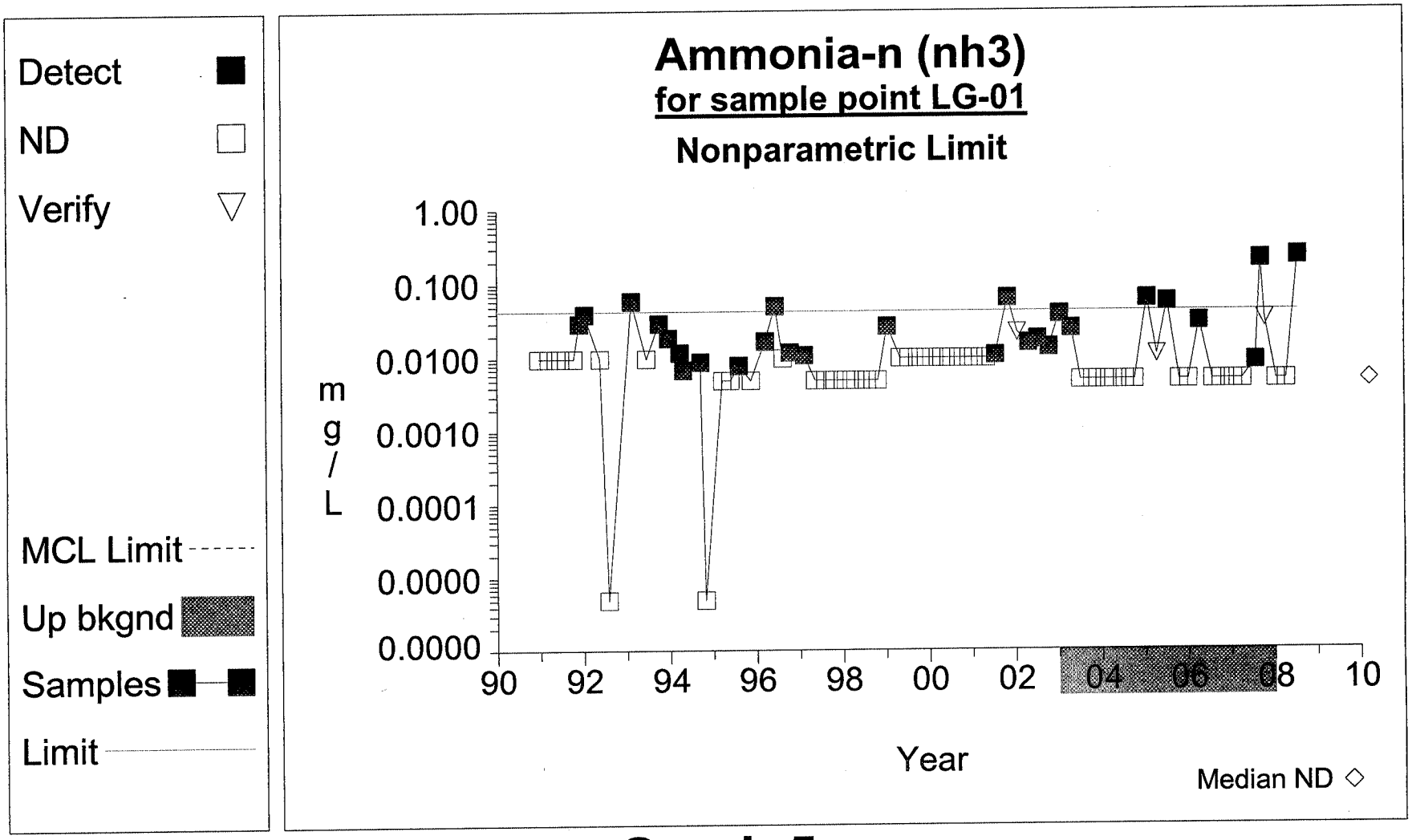
Up vs. Down Prediction Limits



Graph 1

Analysis prepared on: 1/22/2009

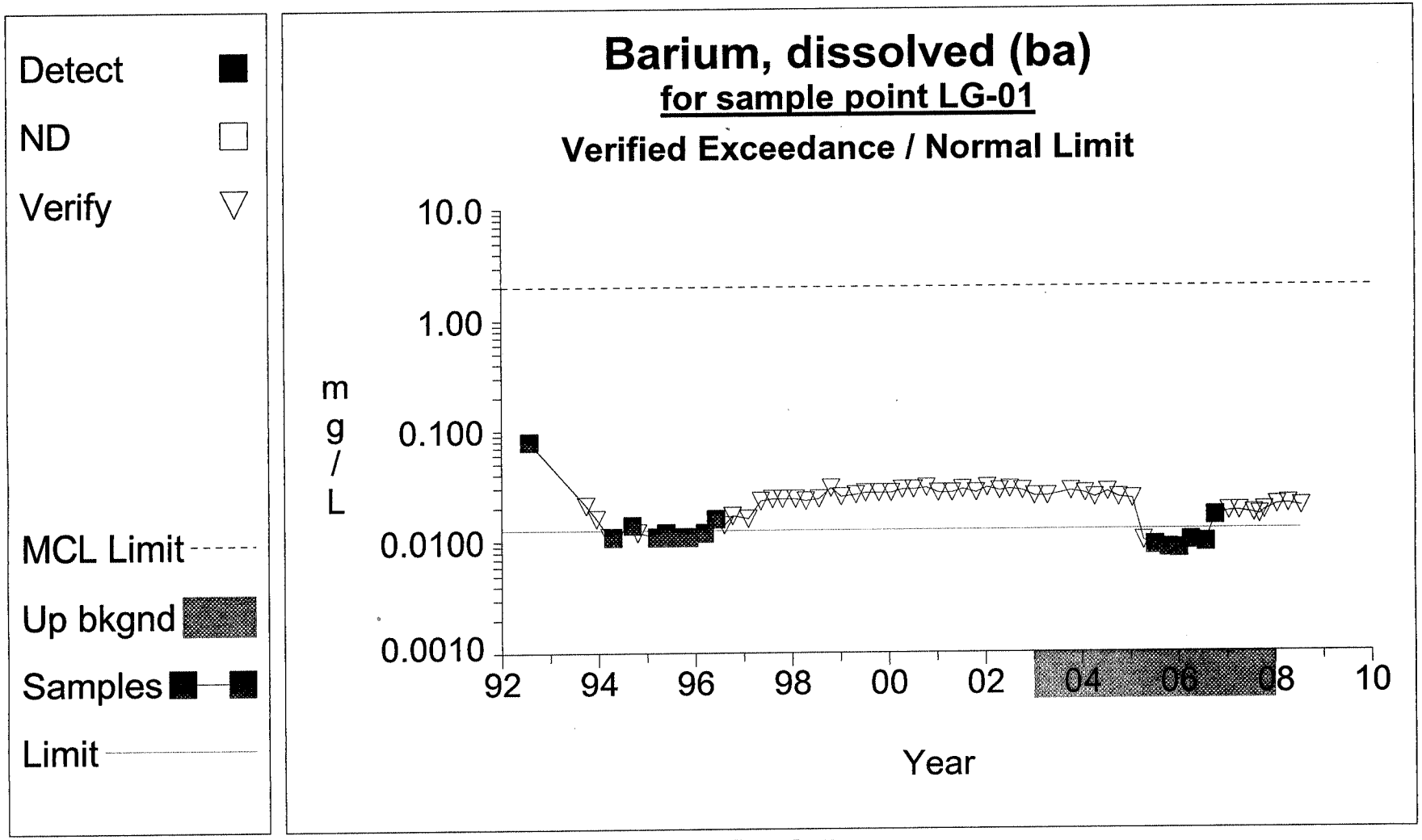
Up vs. Down Prediction Limits



Graph 5

Prepared by: Snohomish County Solid Waste

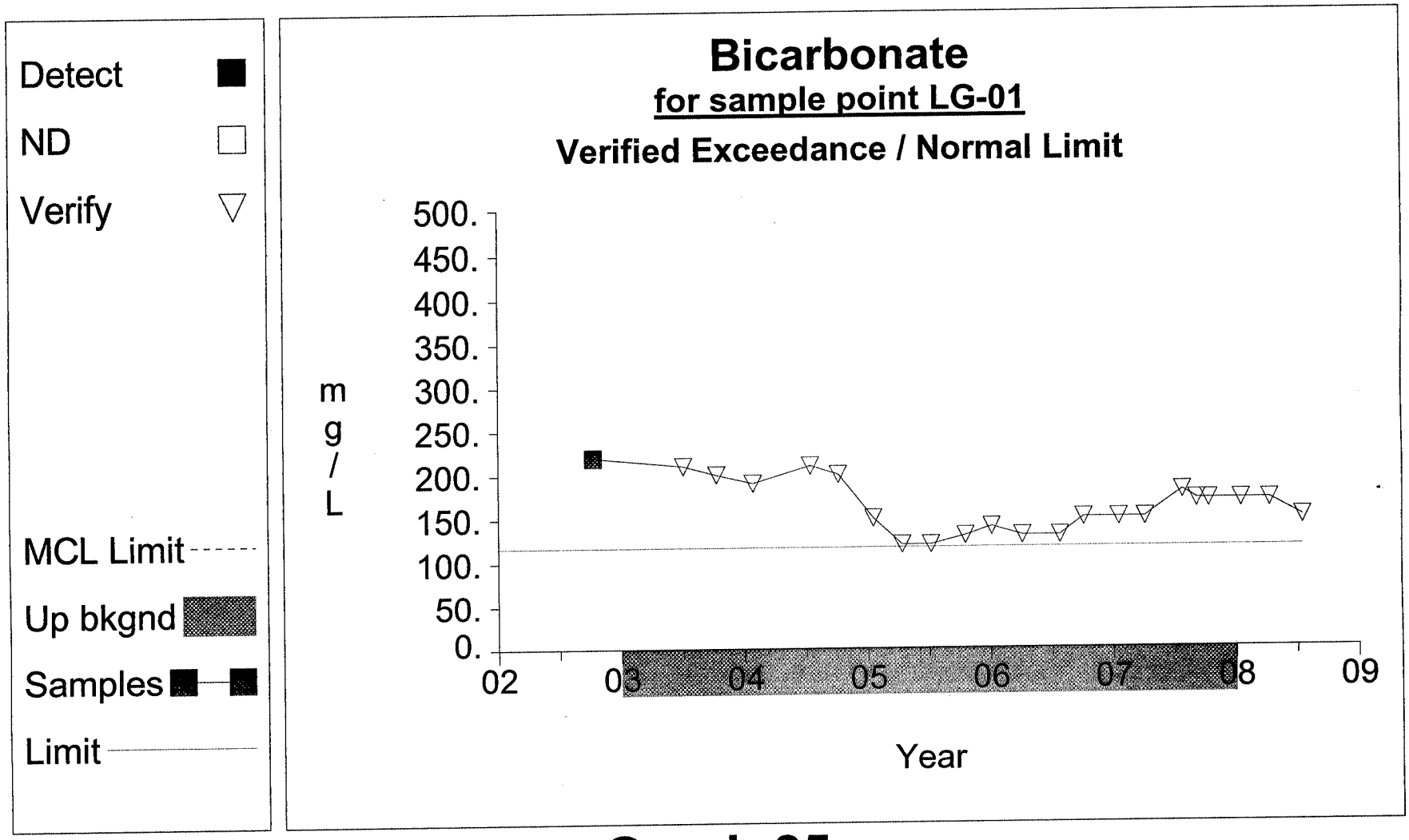
Up vs. Down Prediction Limits



Graph 17

Analysis prepared on: 1/22/2009

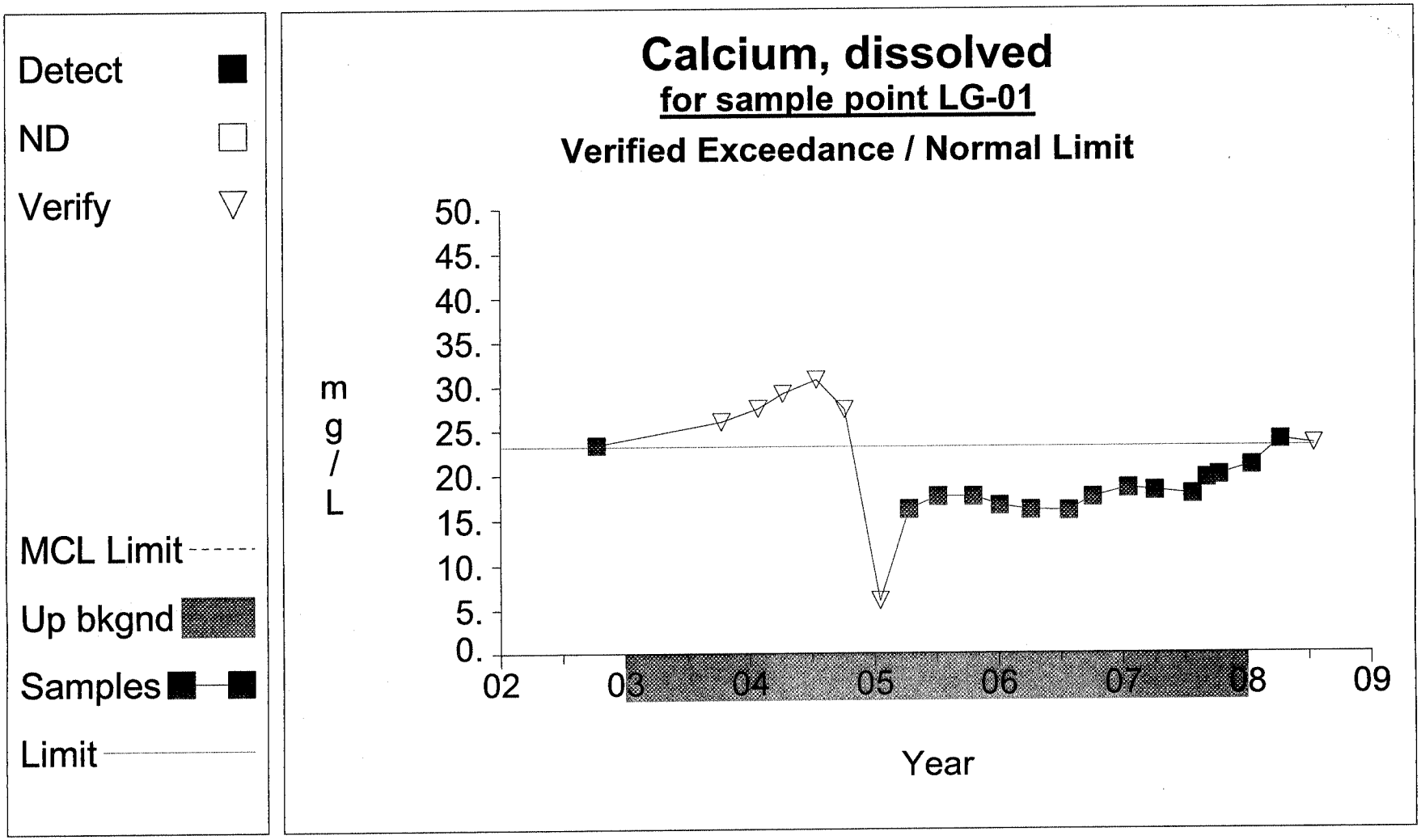
Up vs. Down Prediction Limits



Graph 25

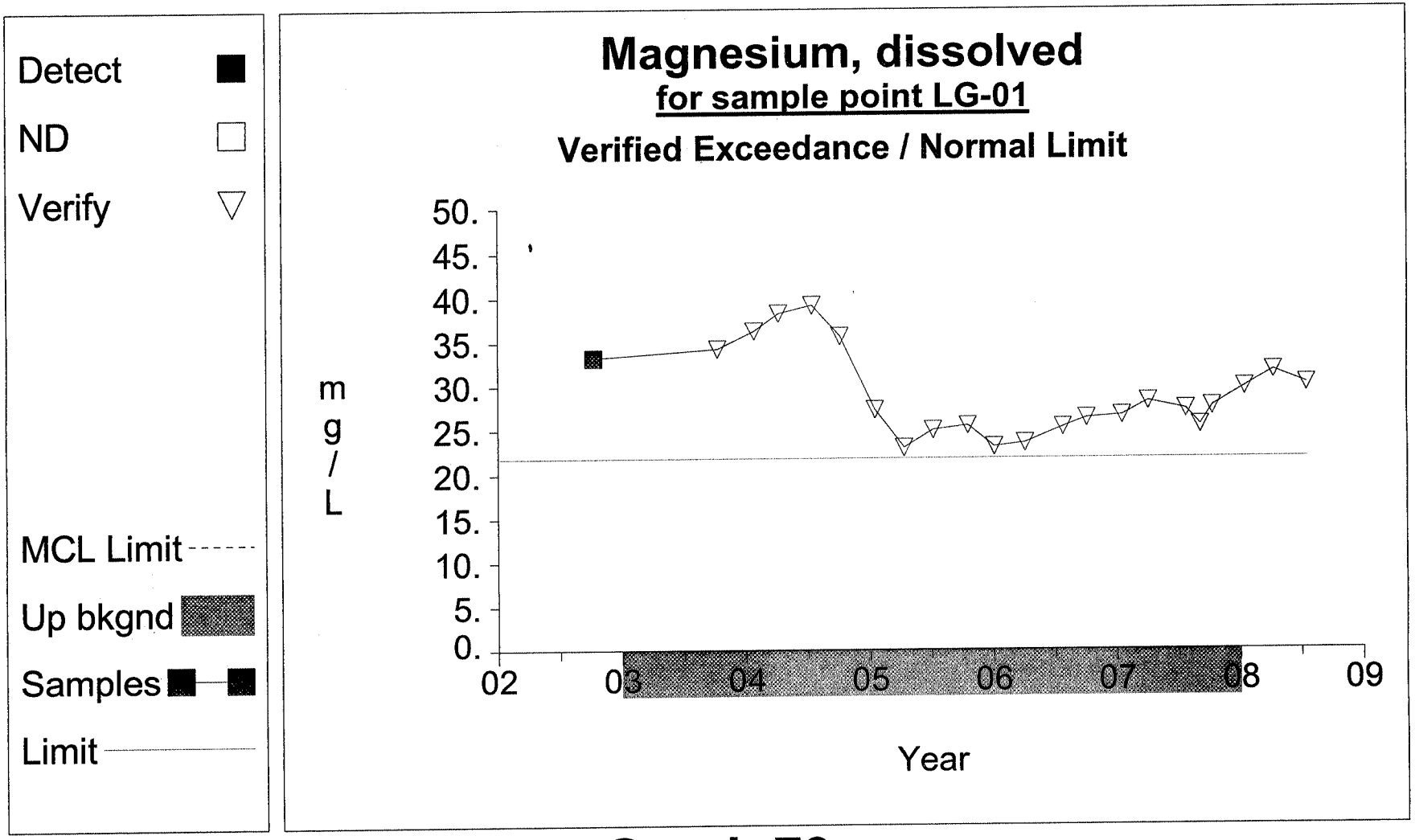
Prepared by: Snohomish County Solid Waste

Up vs. Down Prediction Limits



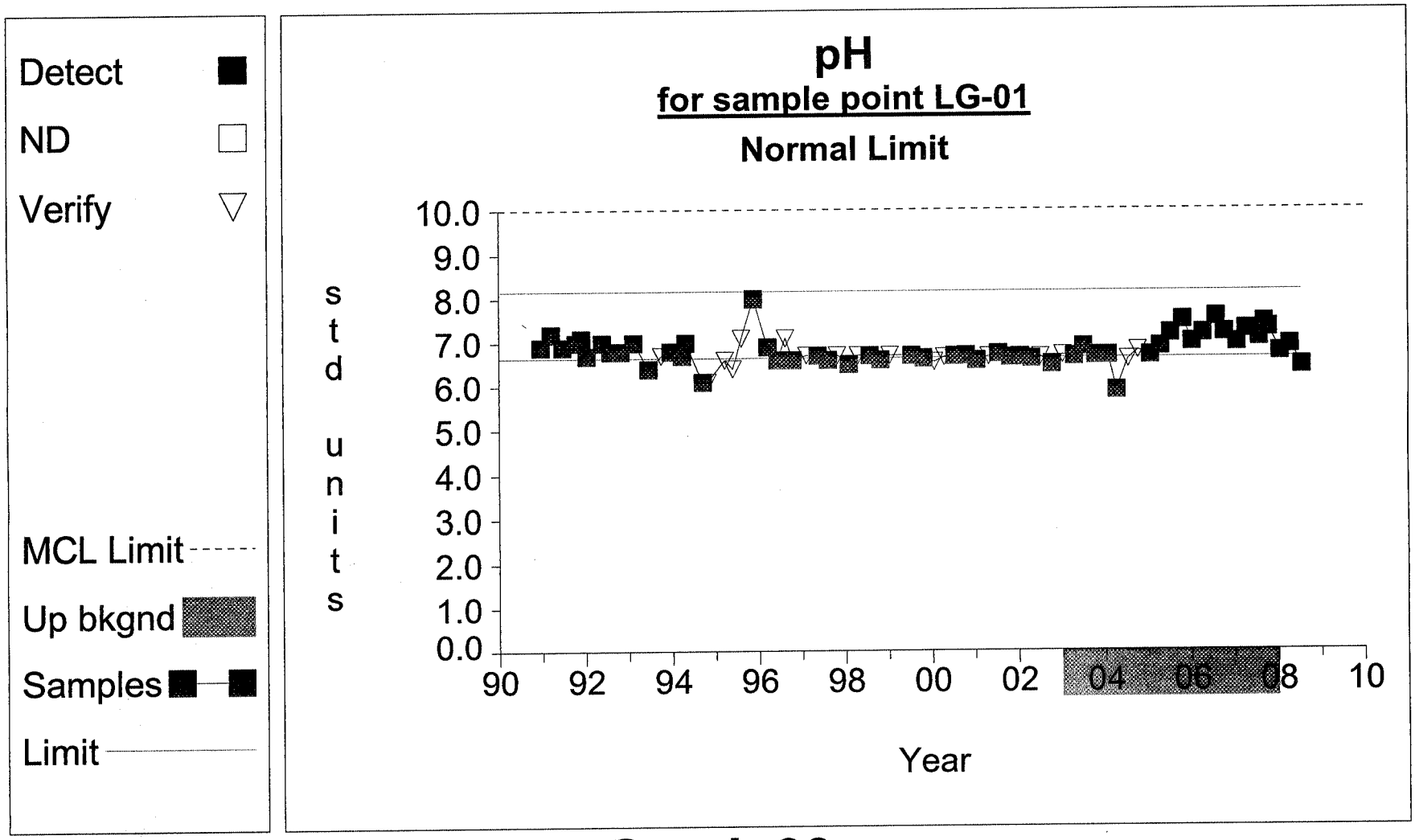
Graph 37

Up vs. Down Prediction Limits



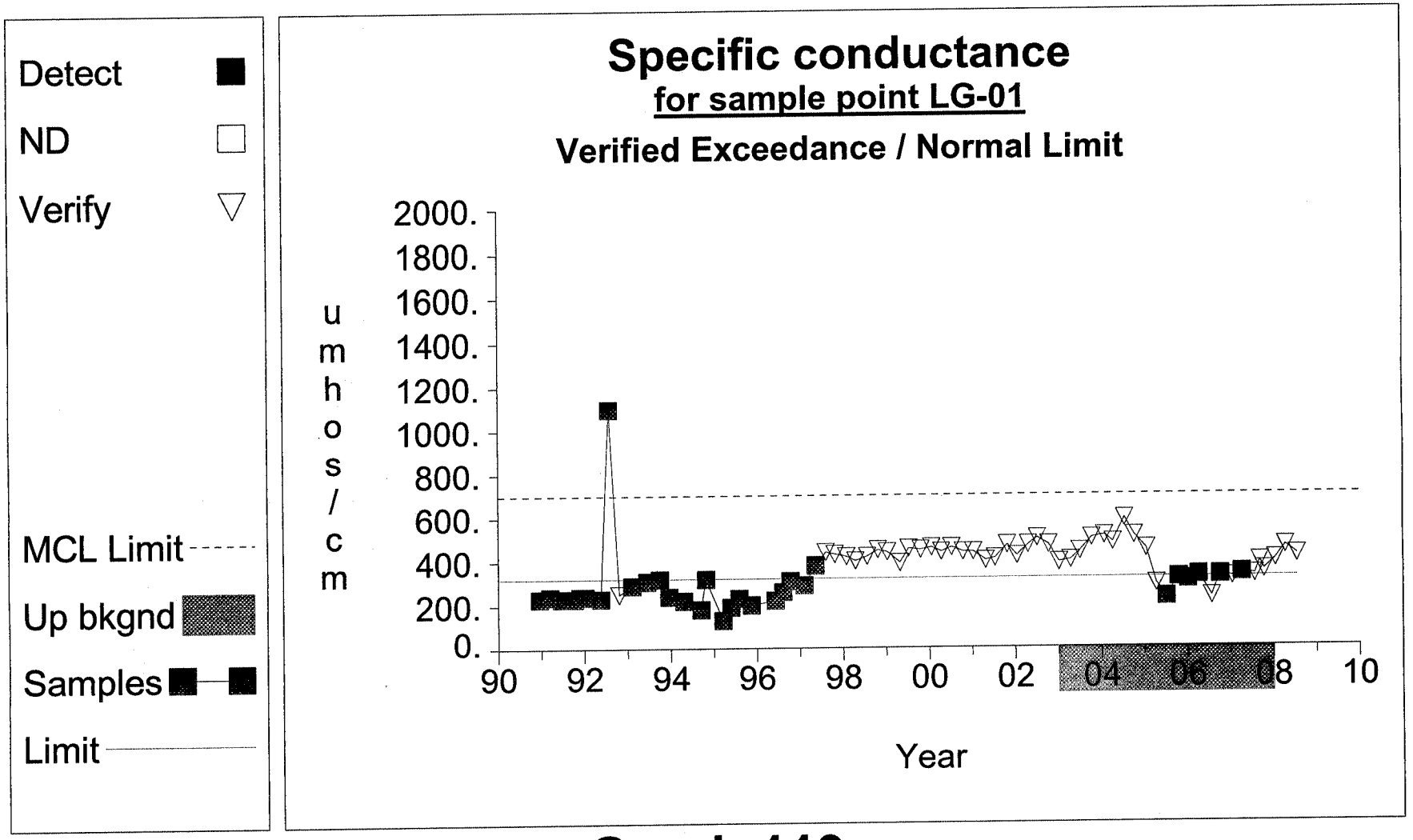
Graph 73

Up vs. Down Prediction Limits



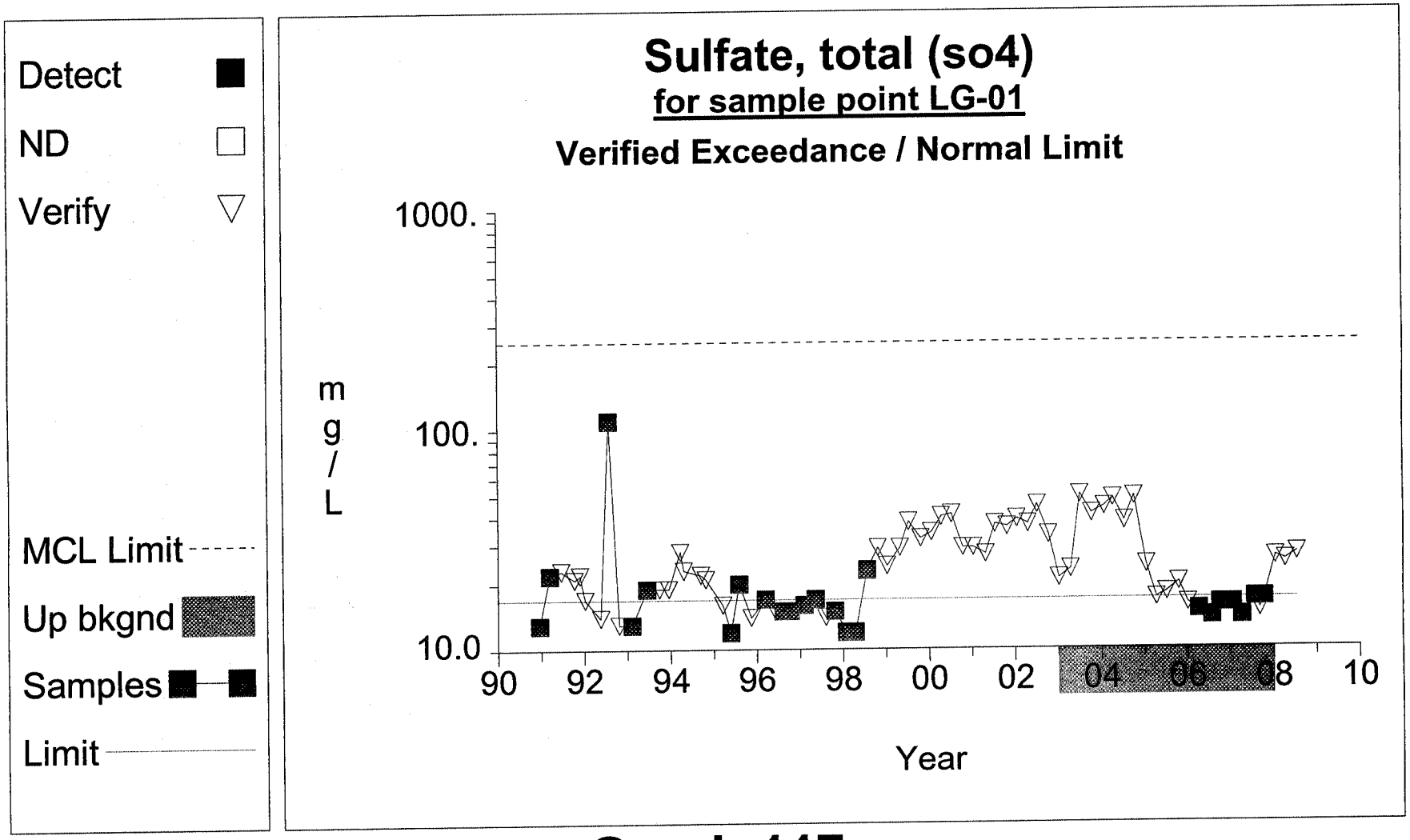
Graph 93

Up vs. Down Prediction Limits



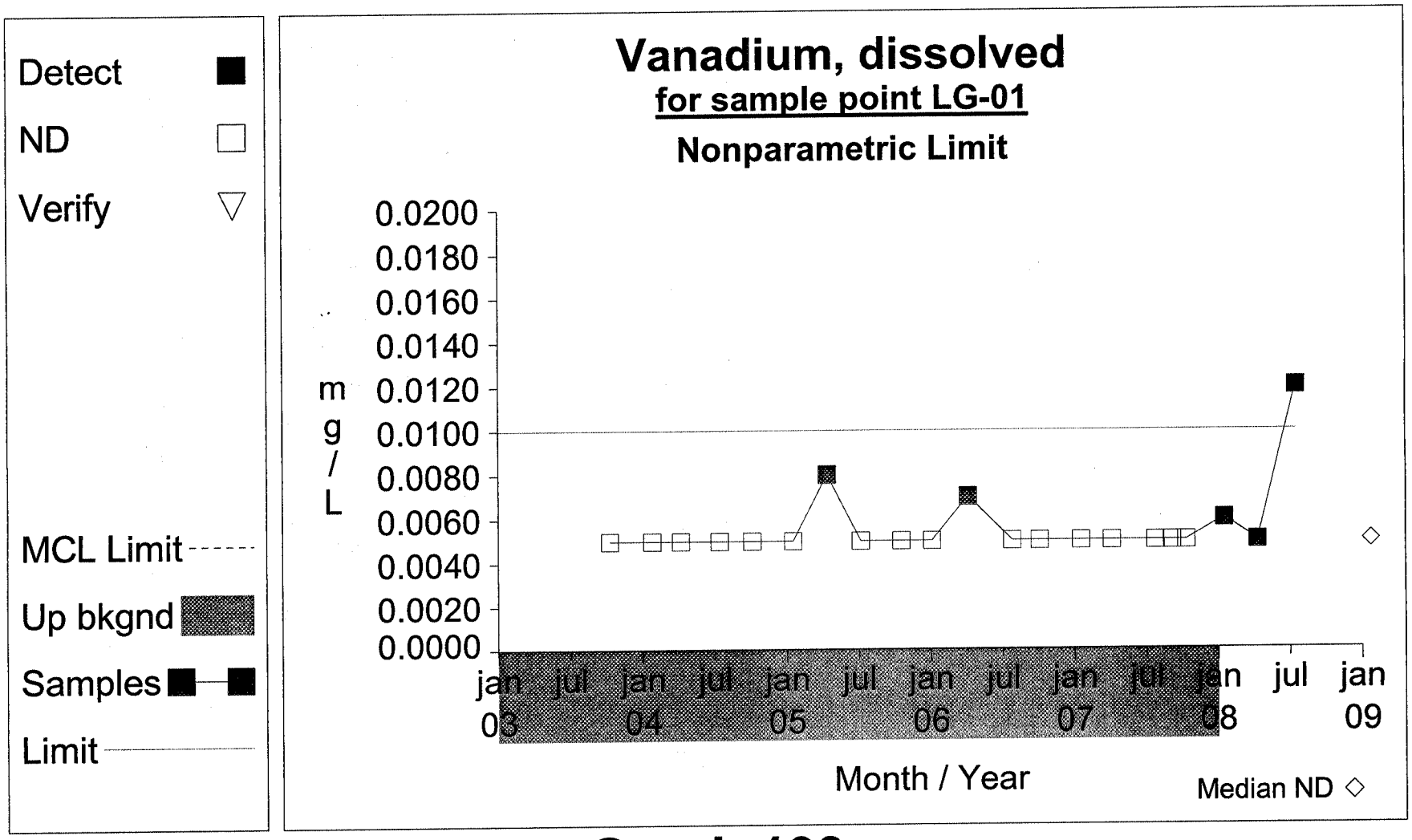
Graph 113

Up vs. Down Prediction Limits



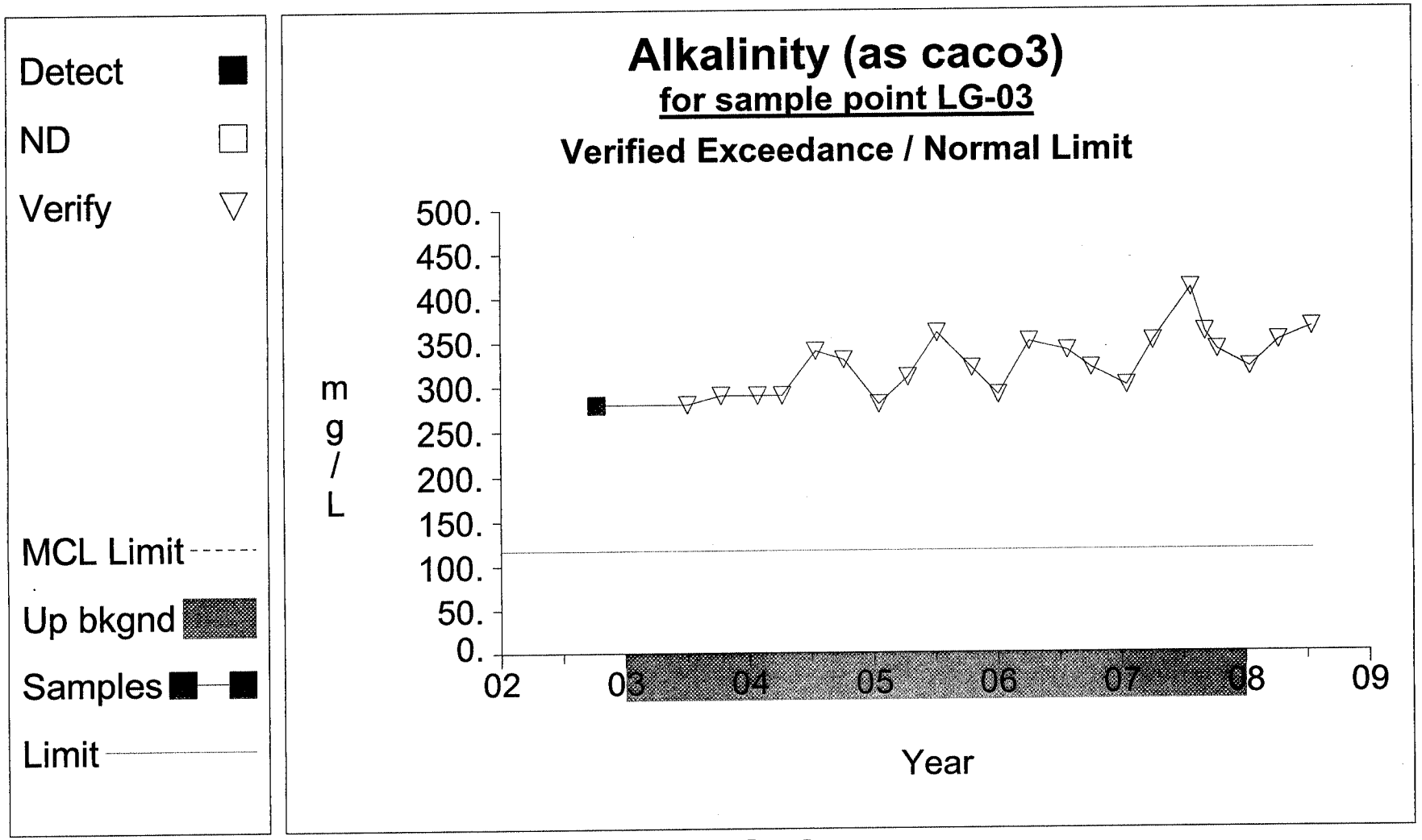
Graph 117

Up vs. Down Prediction Limits



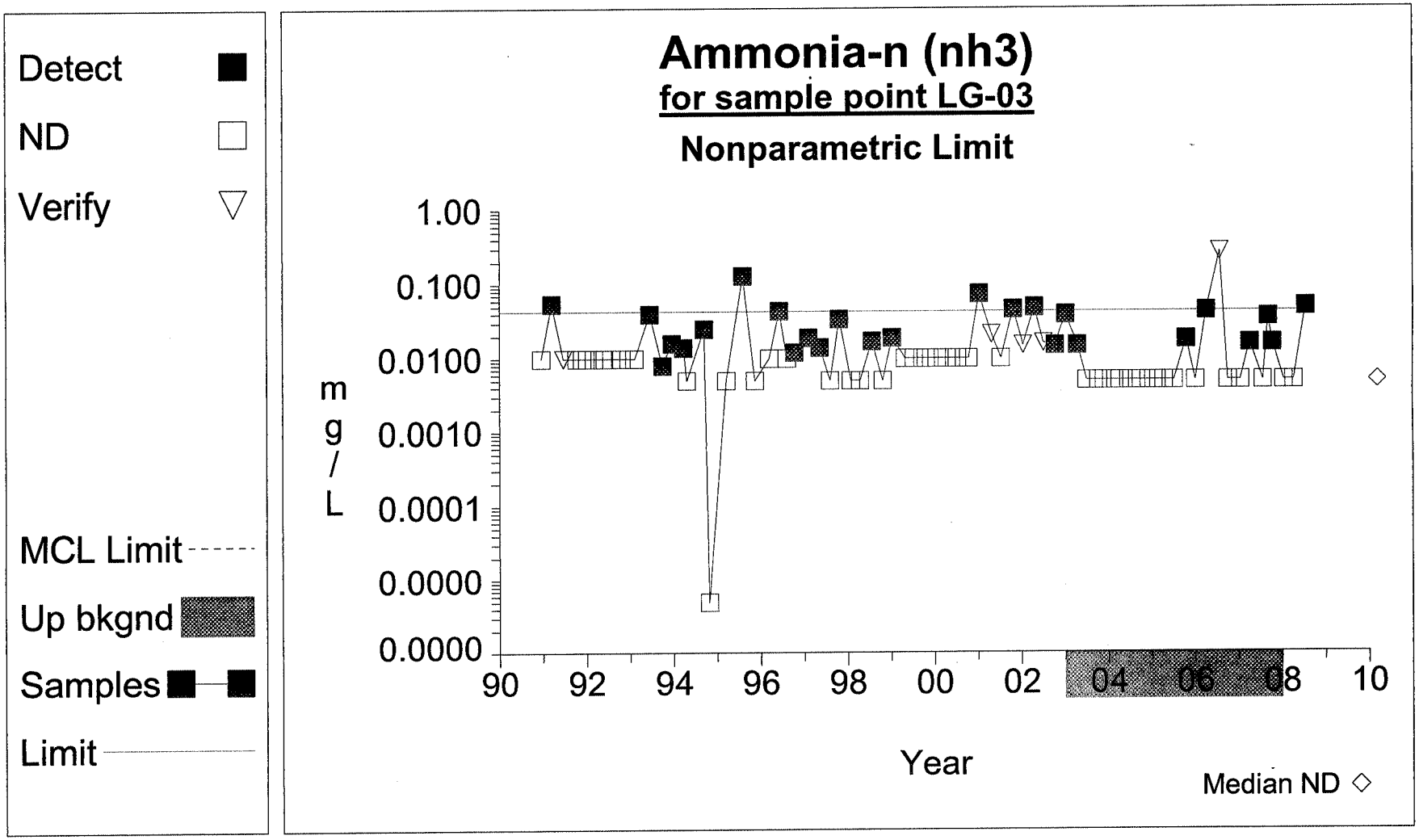
Graph 133

Up vs. Down Prediction Limits



Graph 2

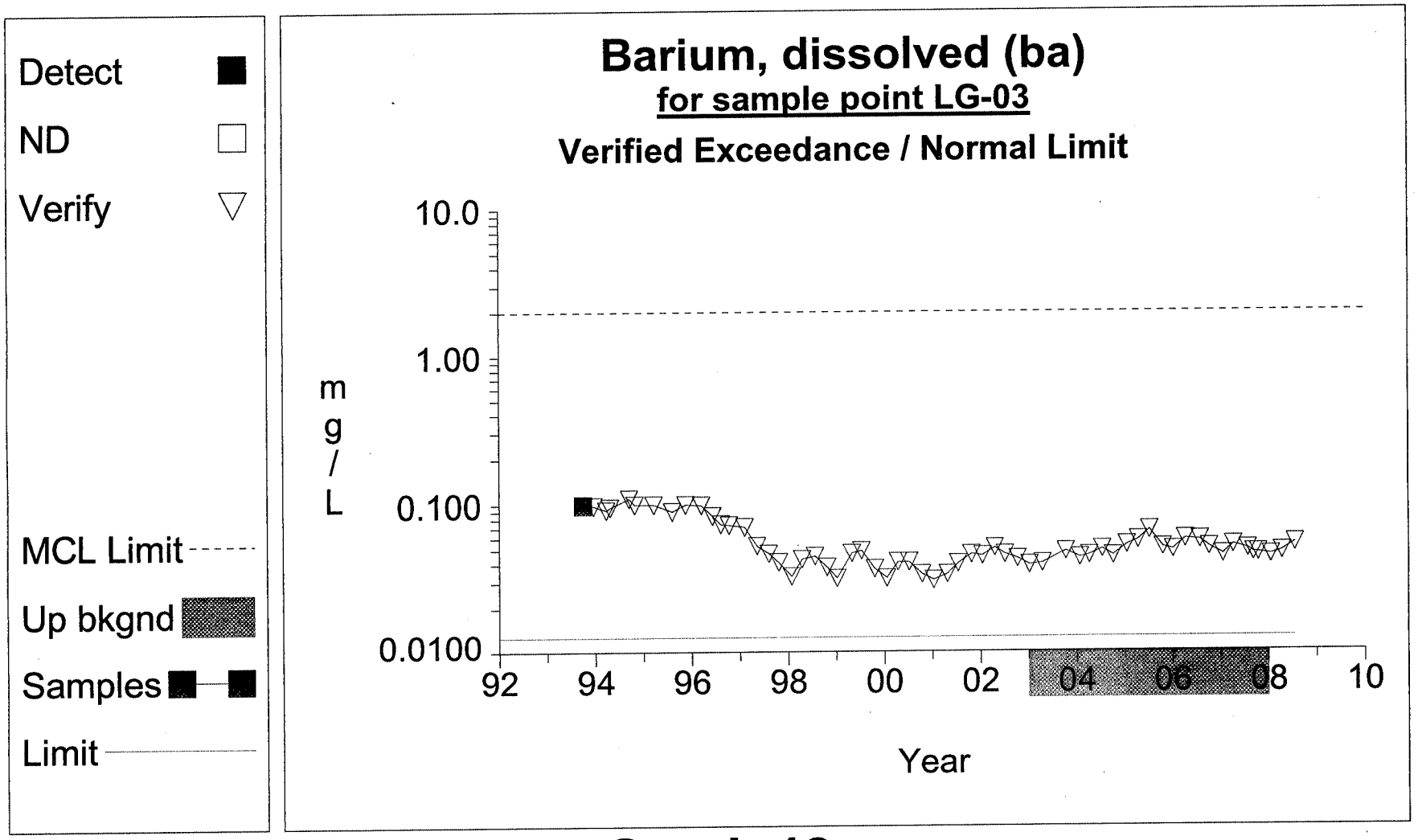
Up vs. Down Prediction Limits



Graph 6

Analysis prepared on: 1/22/2009

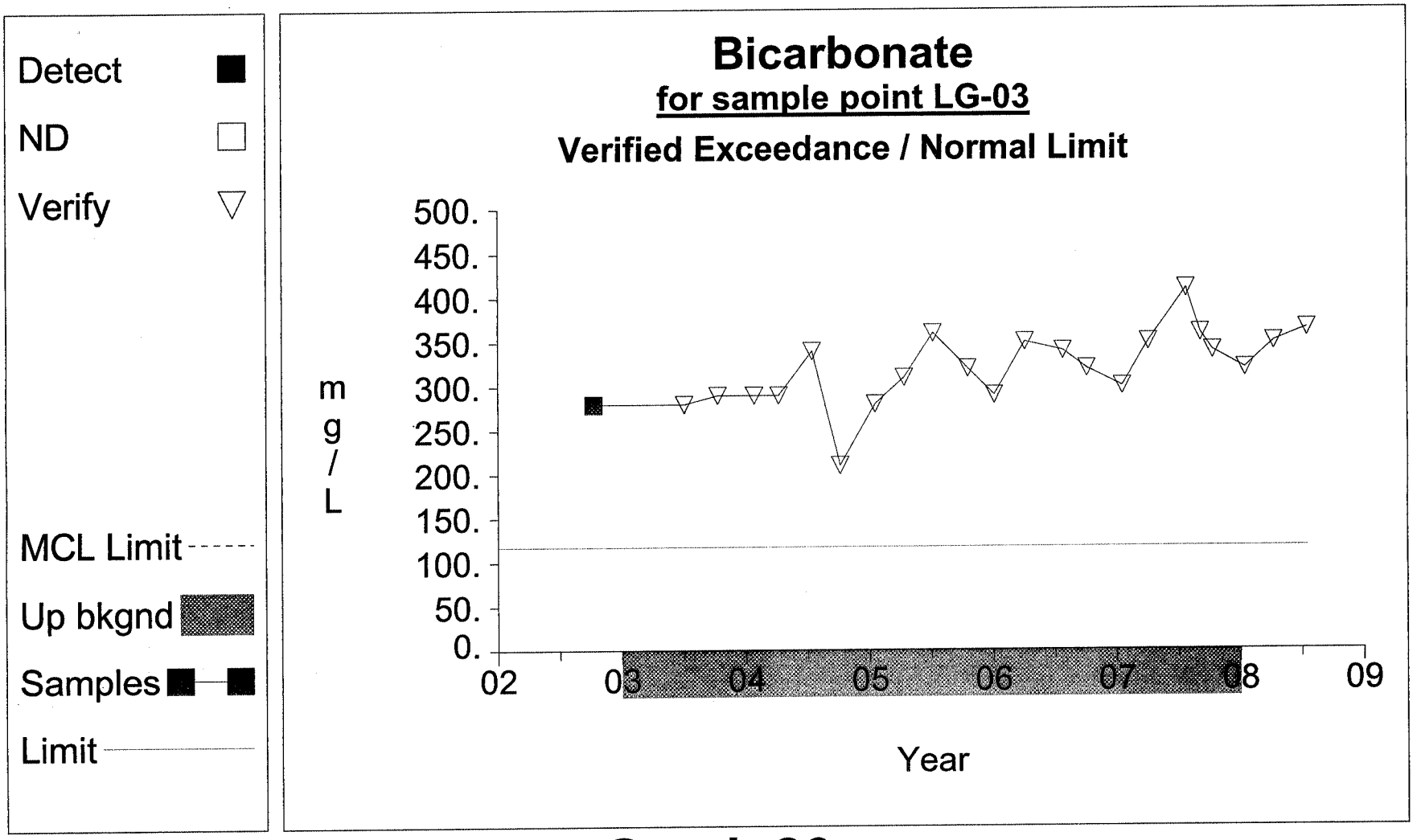
Up vs. Down Prediction Limits



Graph 18

Prepared by: Snohomish County Solid Waste

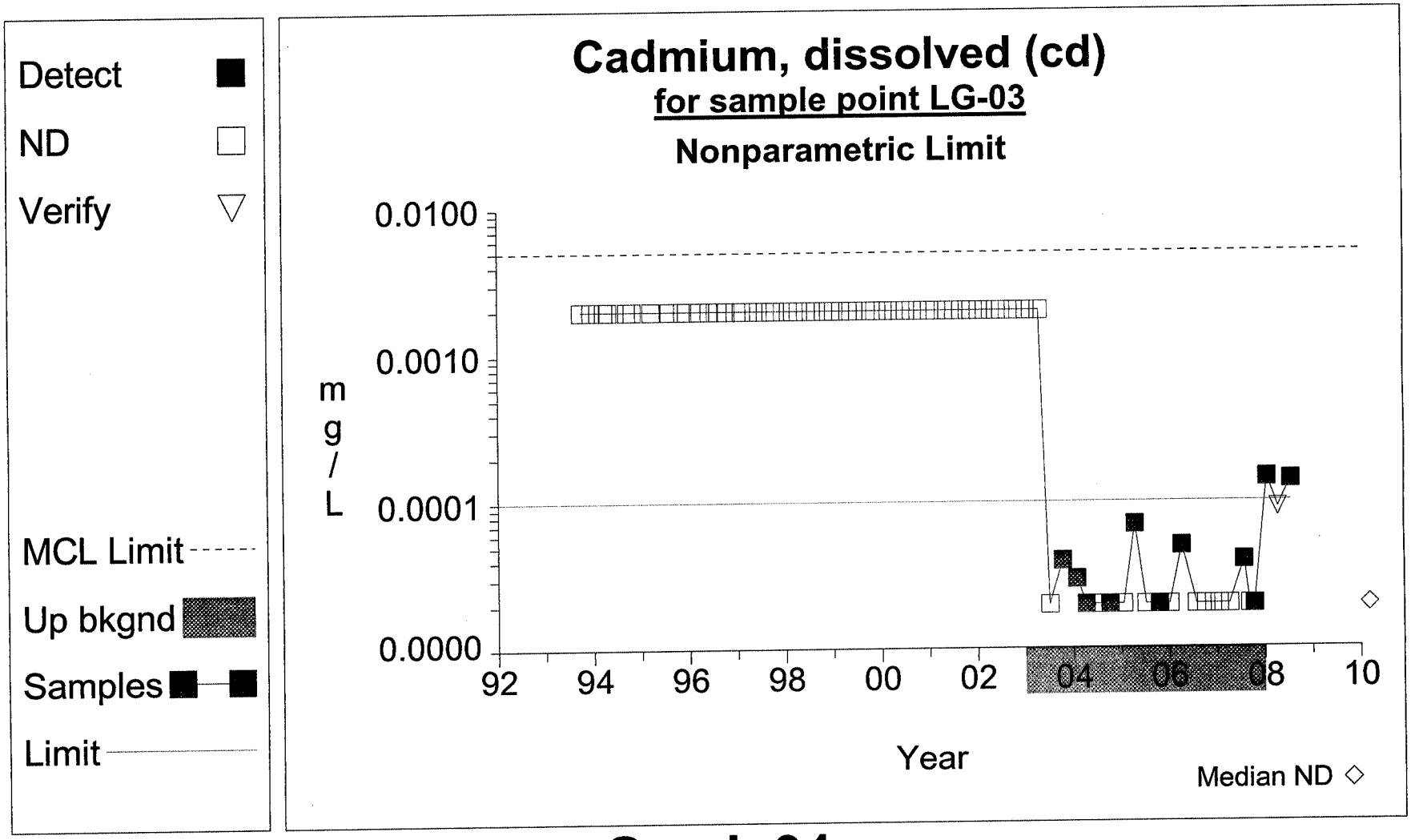
Up vs. Down Prediction Limits



Graph 26

Analysis prepared on: 1/22/2009

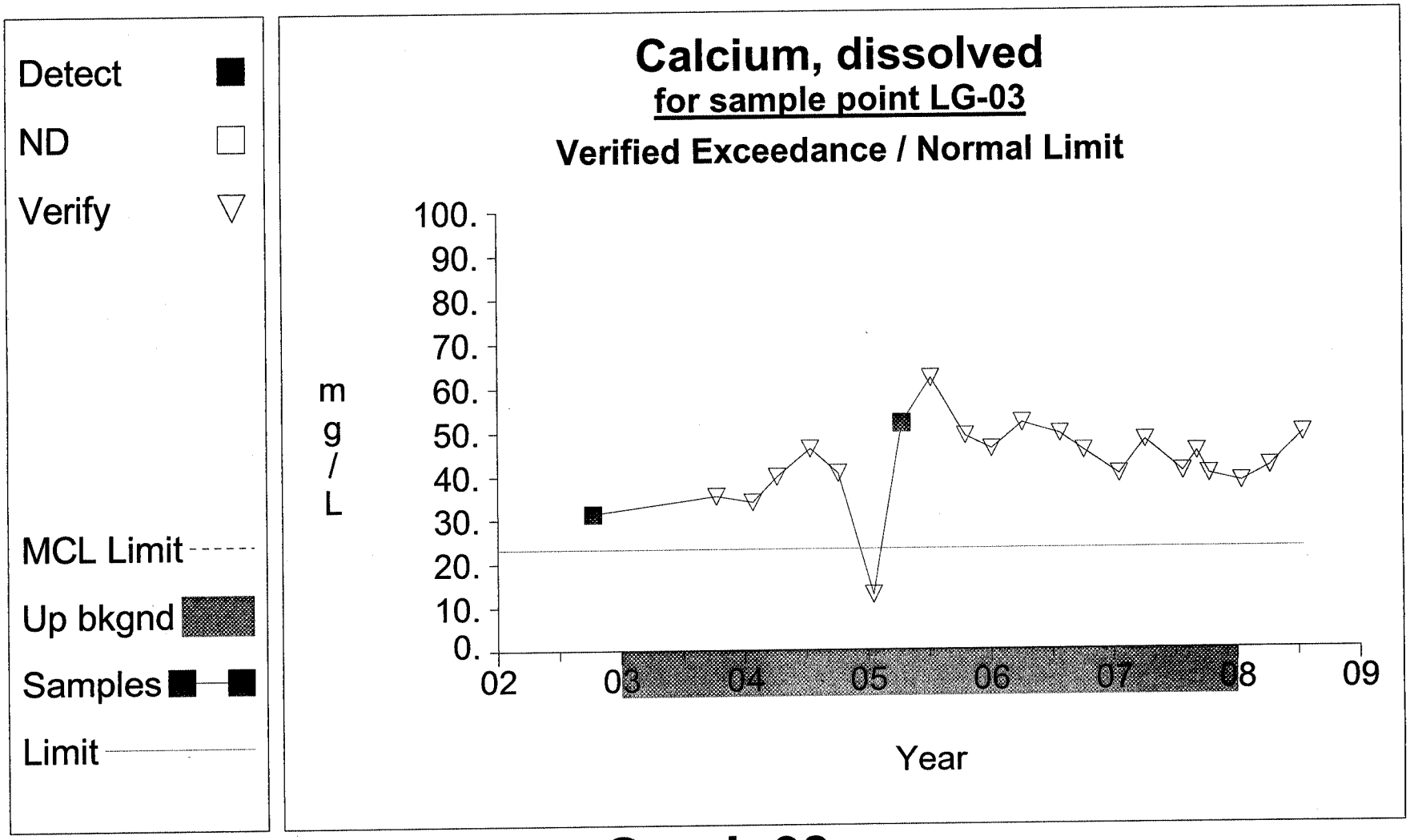
Up vs. Down Prediction Limits



Graph 34

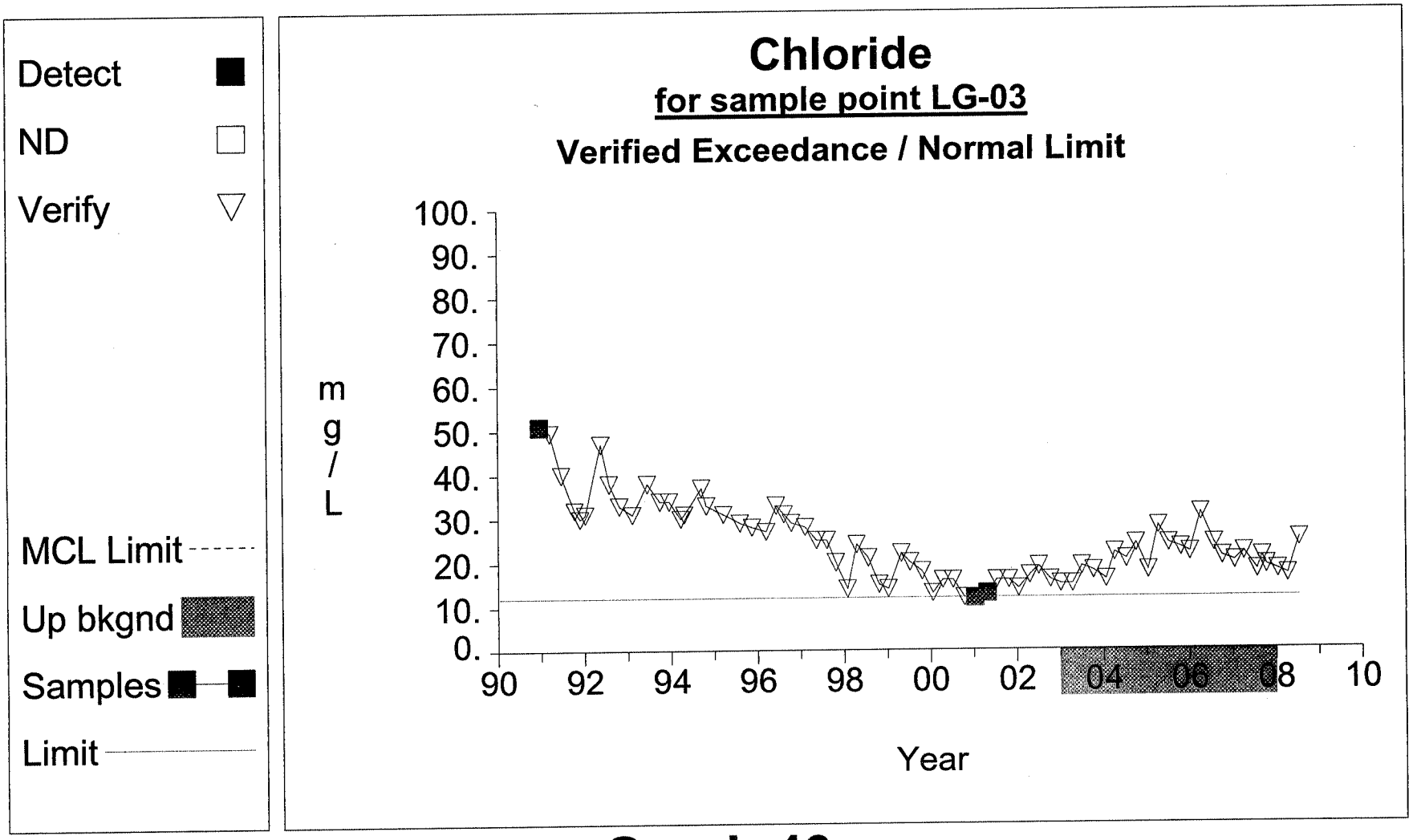
Prepared by: Snohomish County Solid Waste

Up vs. Down Prediction Limits



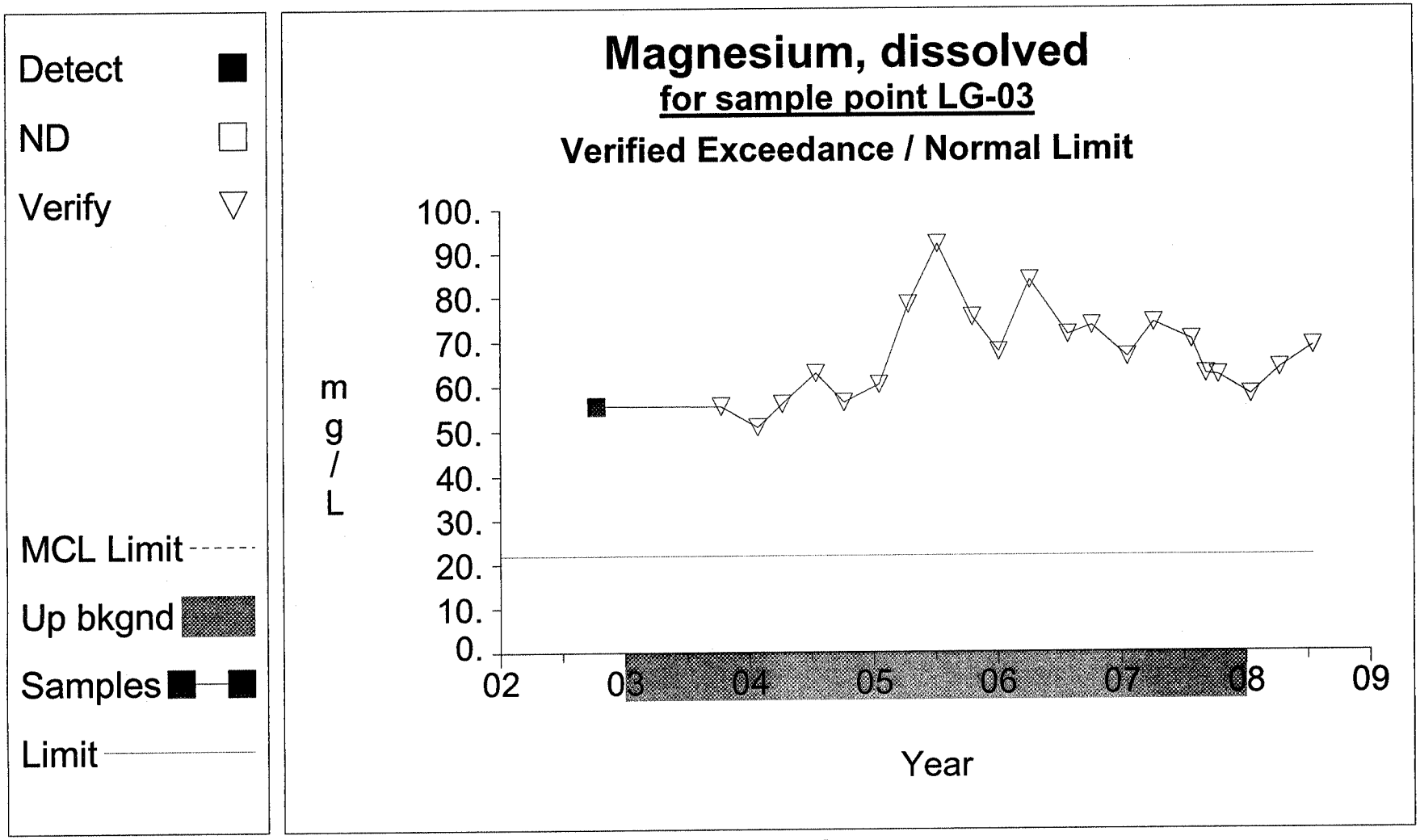
Graph 38

Up vs. Down Prediction Limits



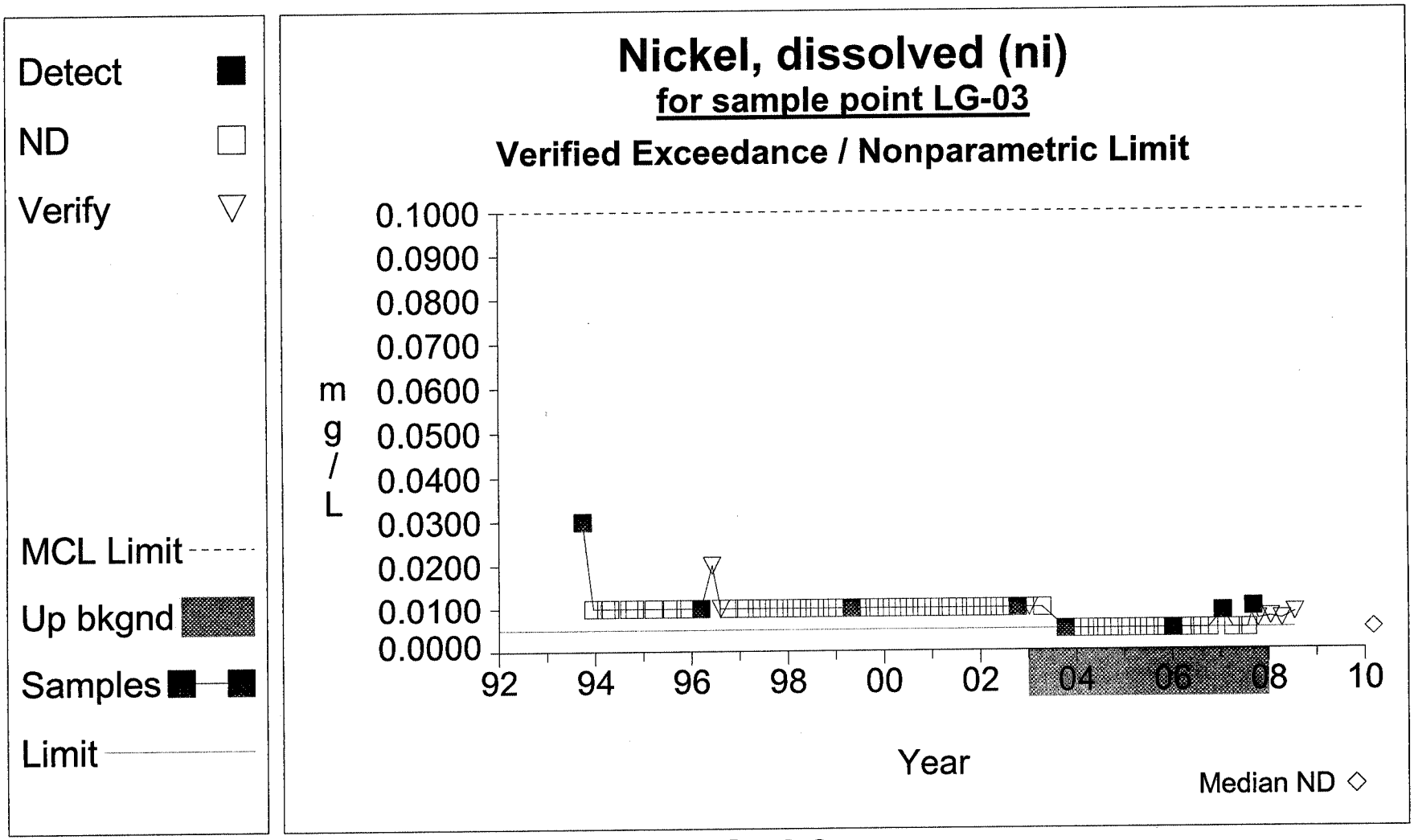
Graph 46

Up vs. Down Prediction Limits



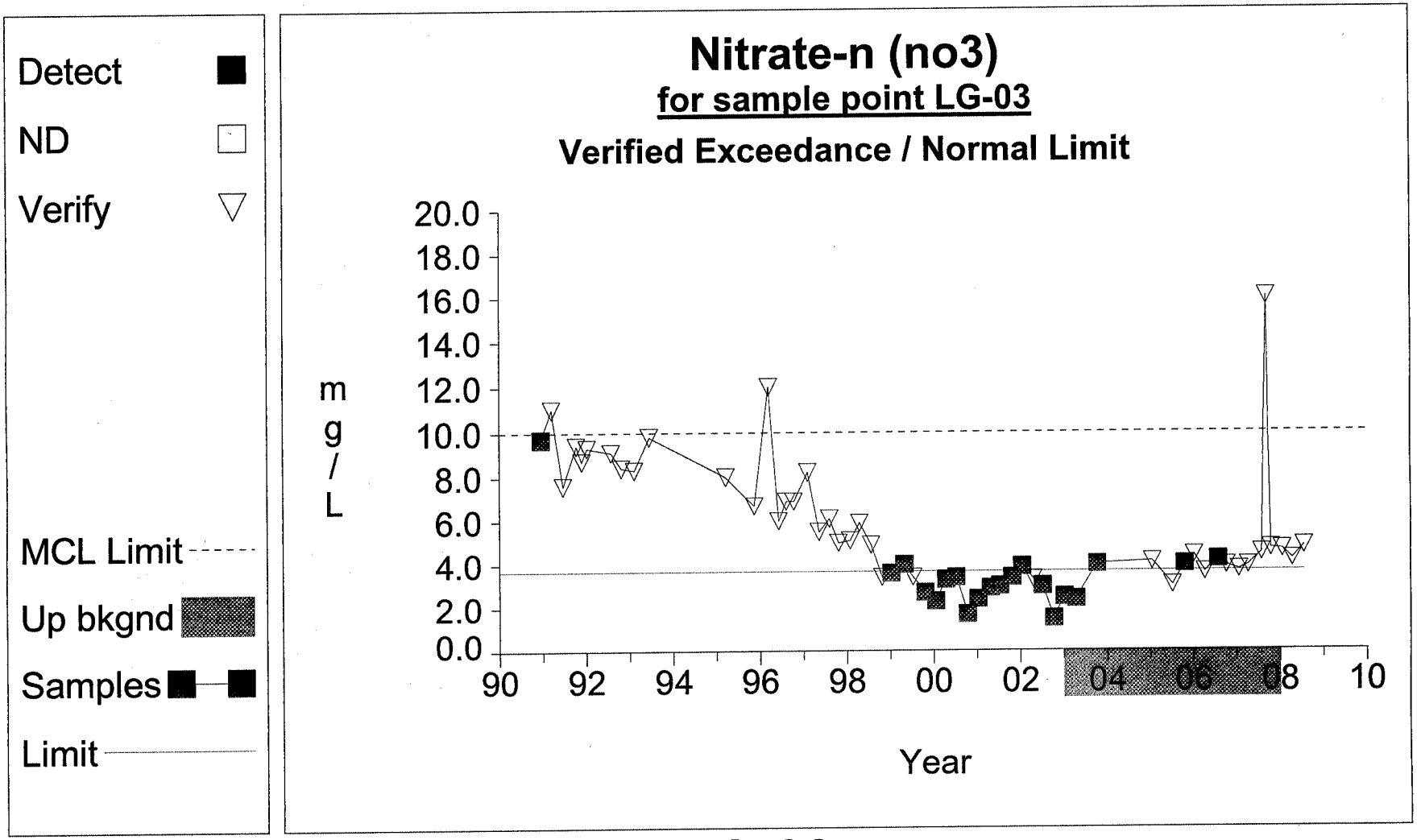
Graph 74

Up vs. Down Prediction Limits



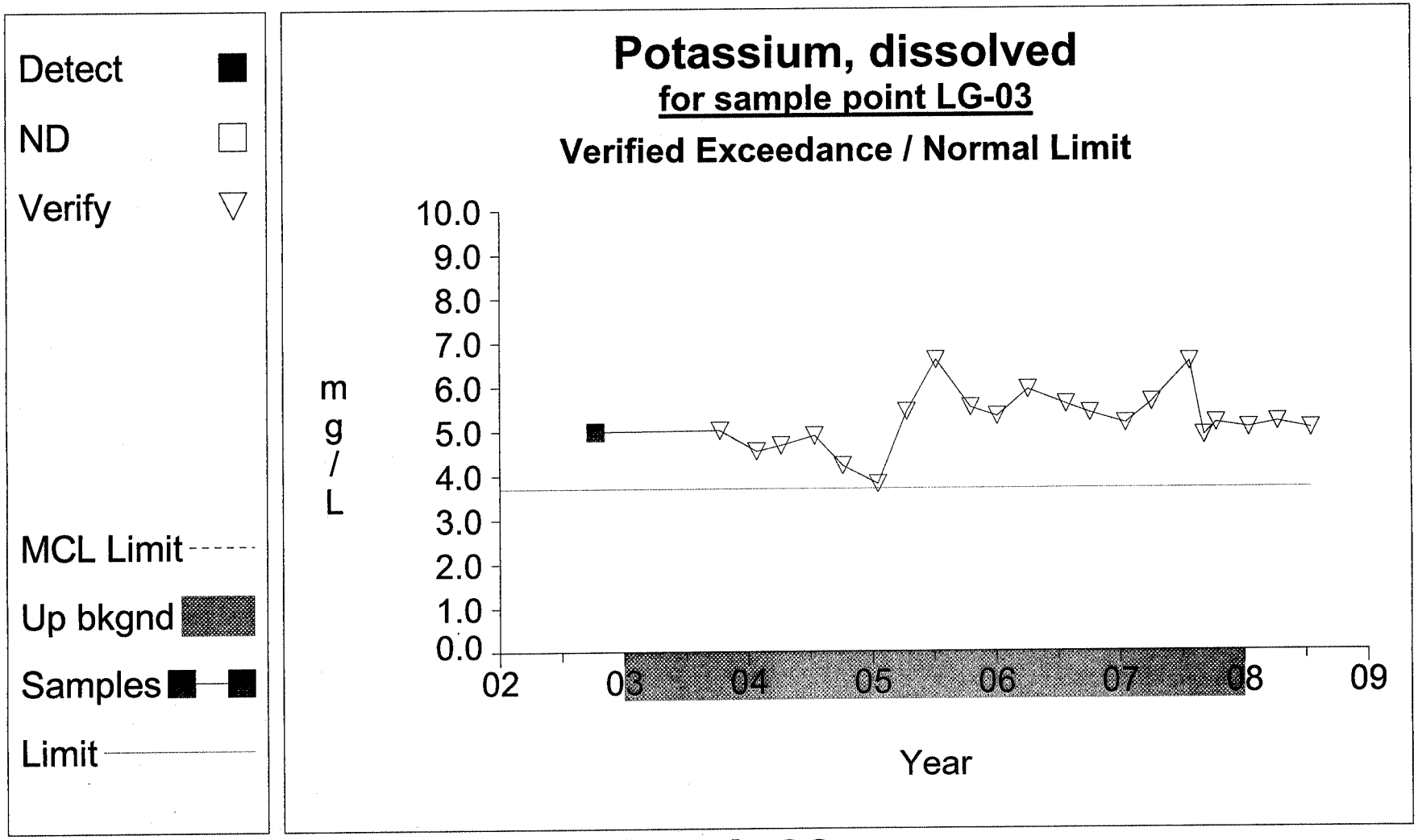
Graph 86

Up vs. Down Prediction Limits



Graph 90

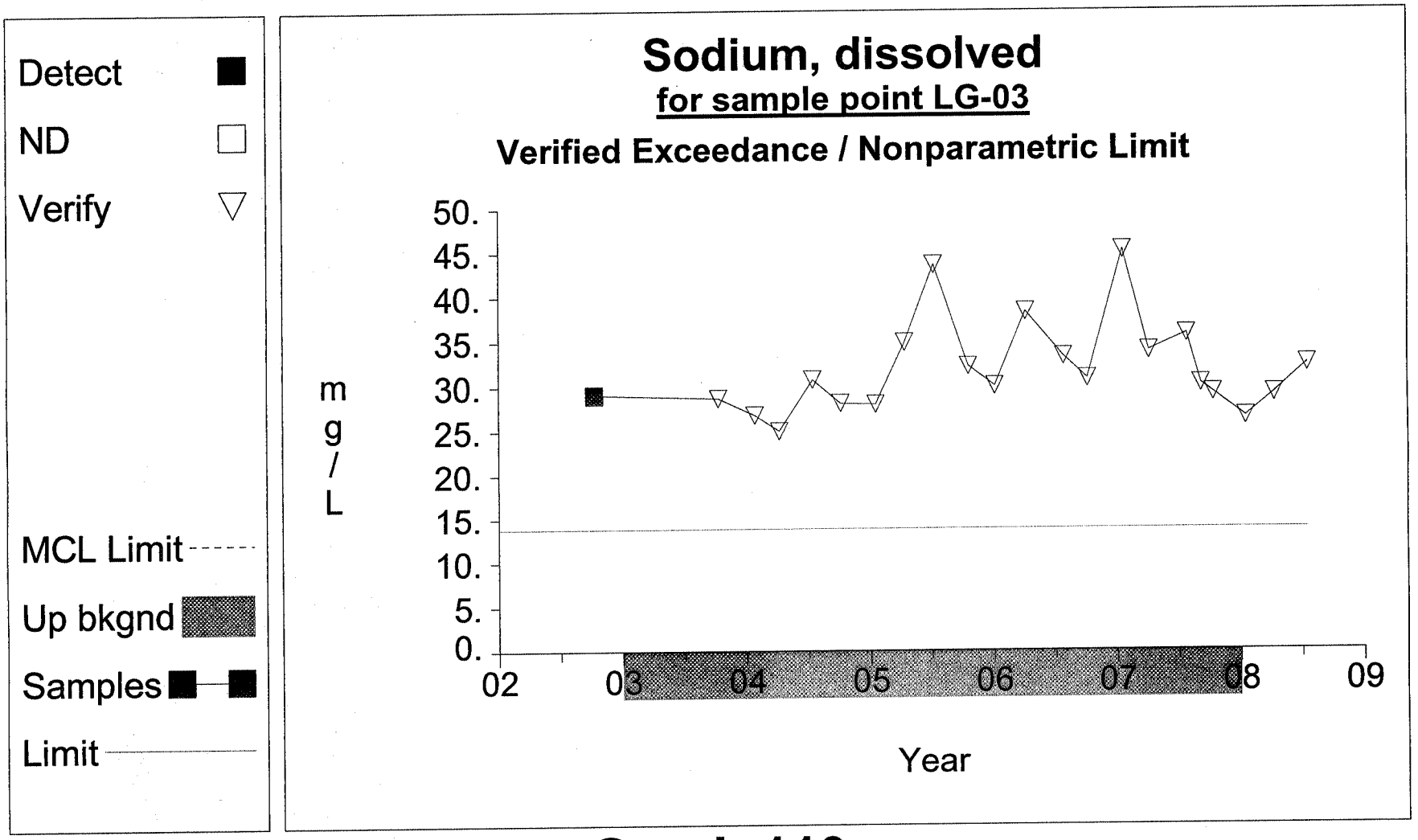
Up vs. Down Prediction Limits



Graph 98

Analysis prepared on: 1/22/2009

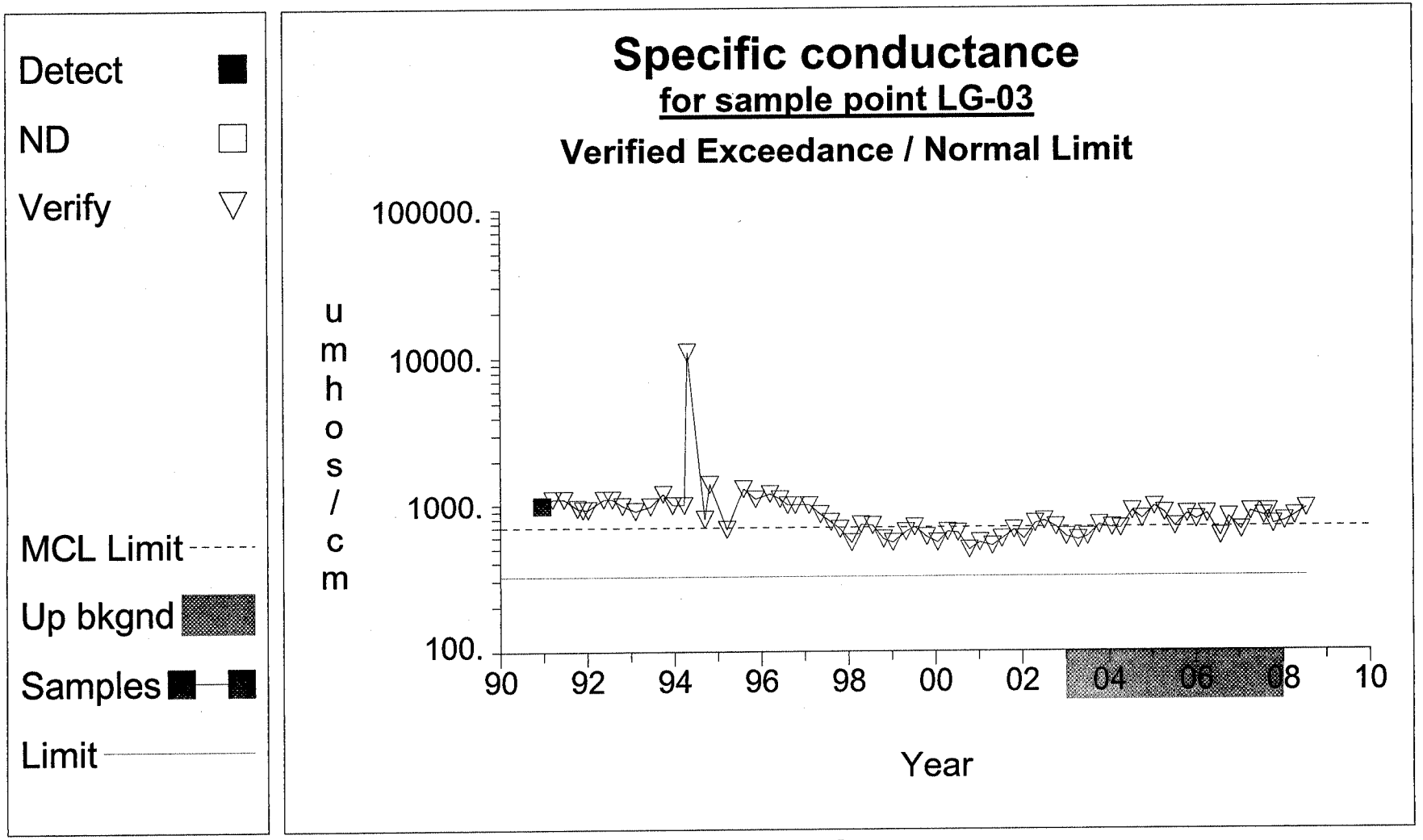
Up vs. Down Prediction Limits



Graph 110

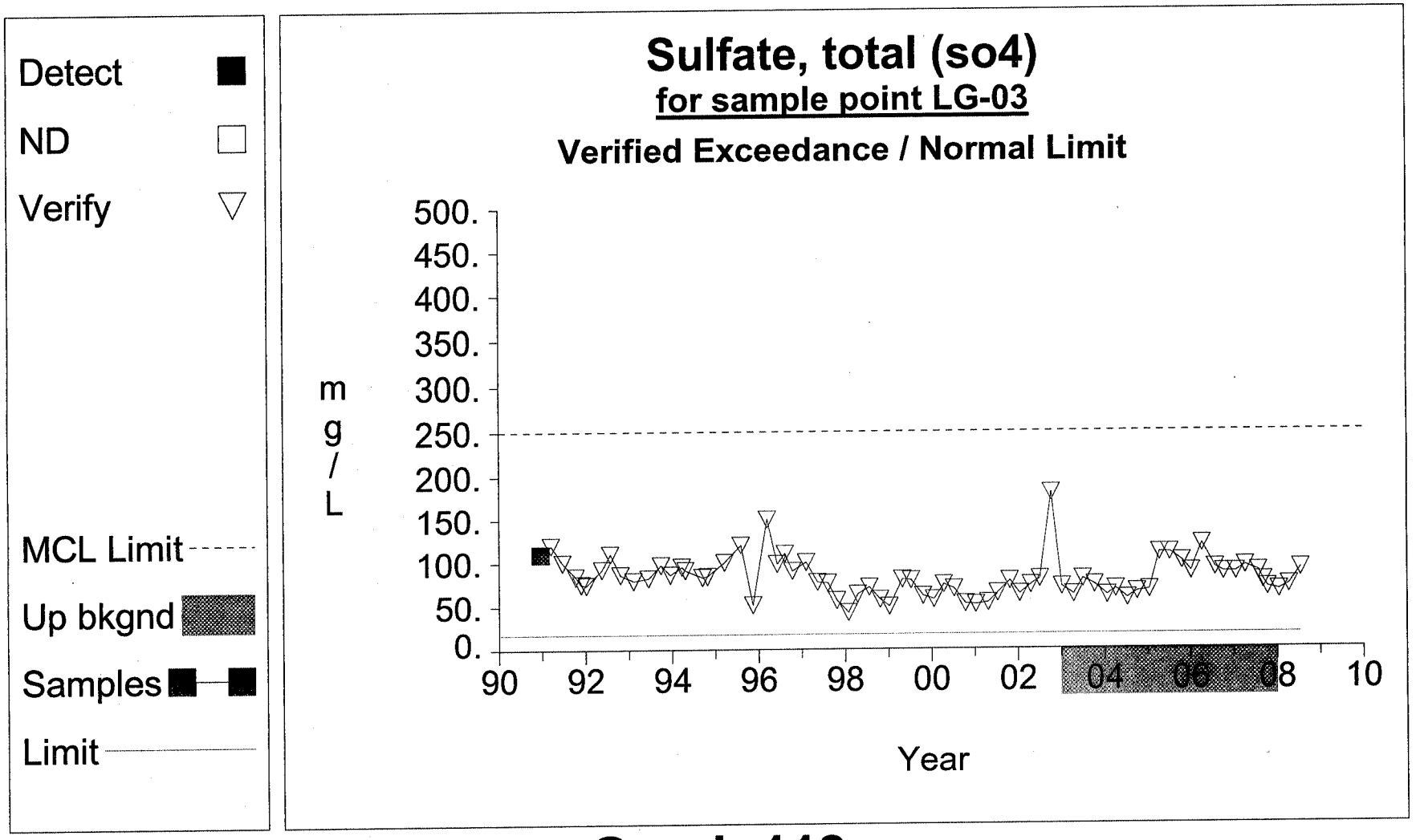
Prepared by: Snohomish County Solid Waste

Up vs. Down Prediction Limits



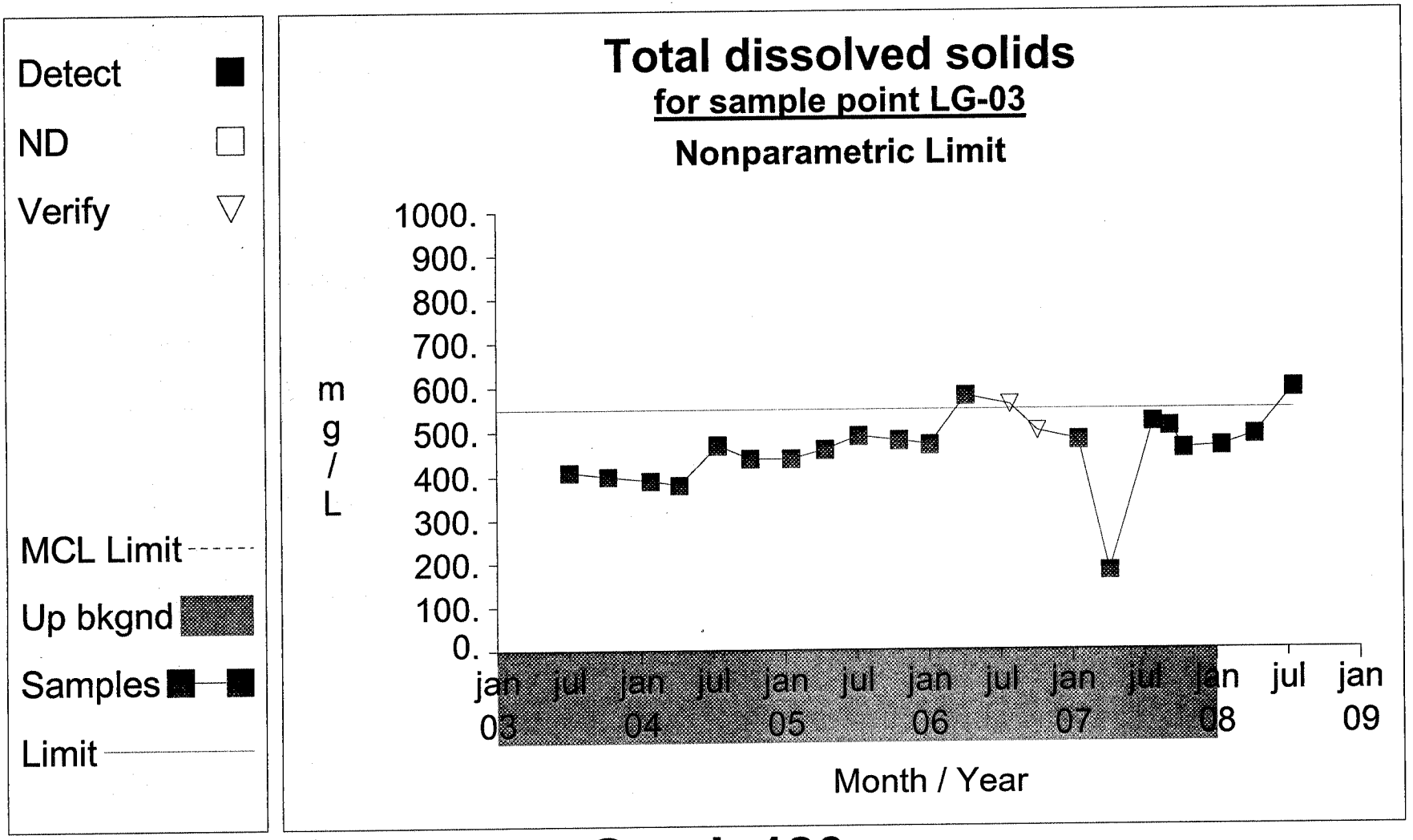
Graph 114

Up vs. Down Prediction Limits



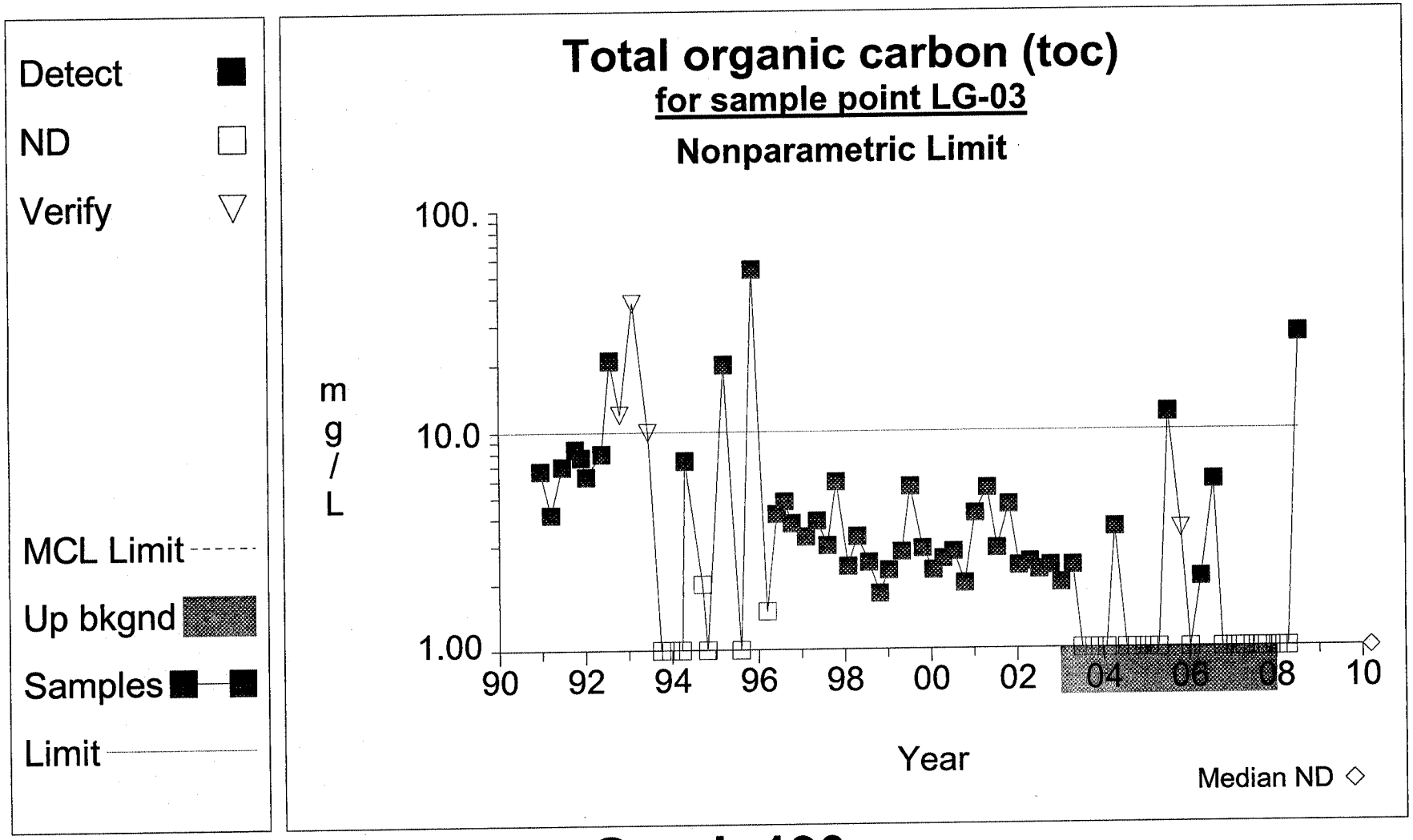
Graph 118

Up vs. Down Prediction Limits



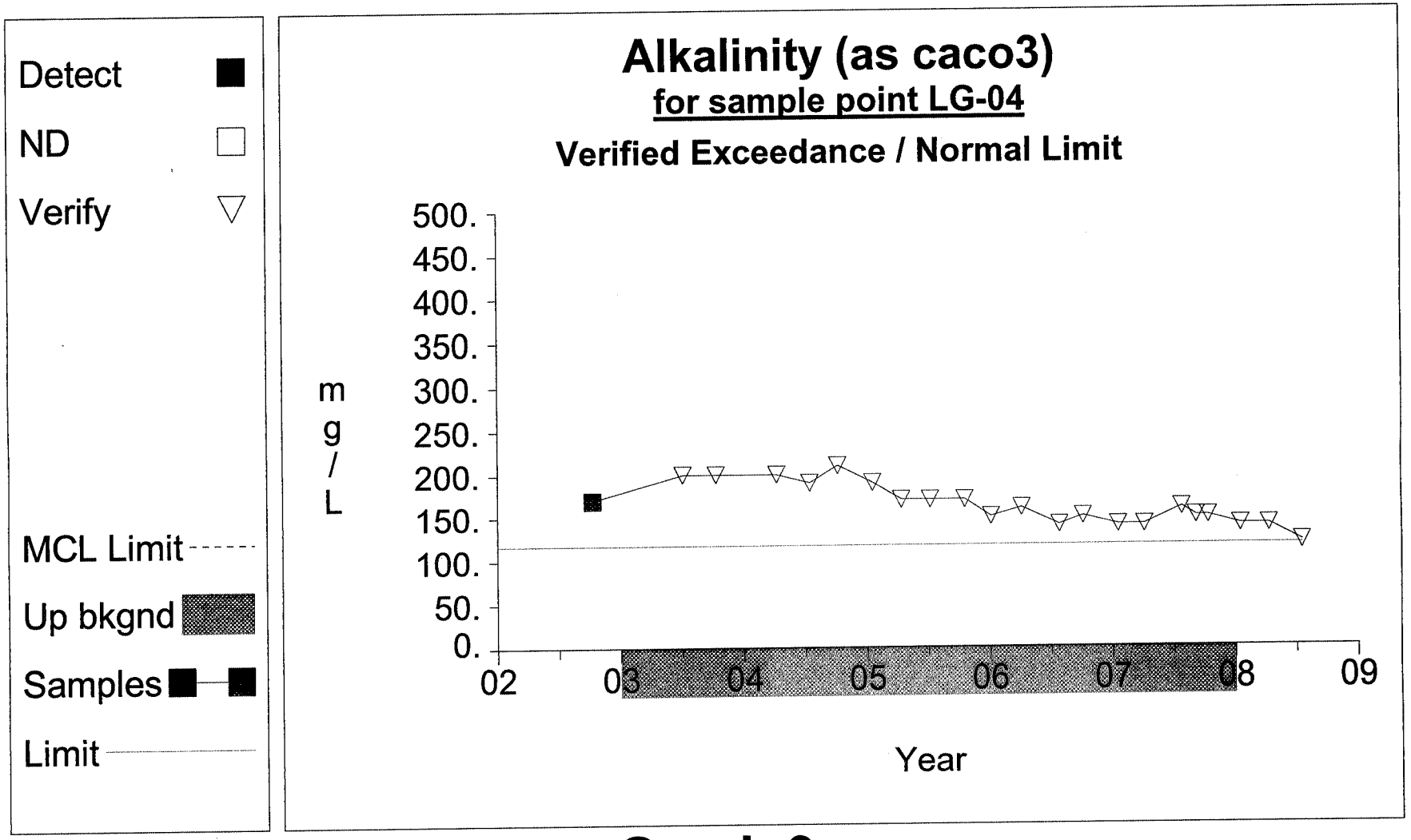
Graph 126

Up vs. Down Prediction Limits



Graph 130

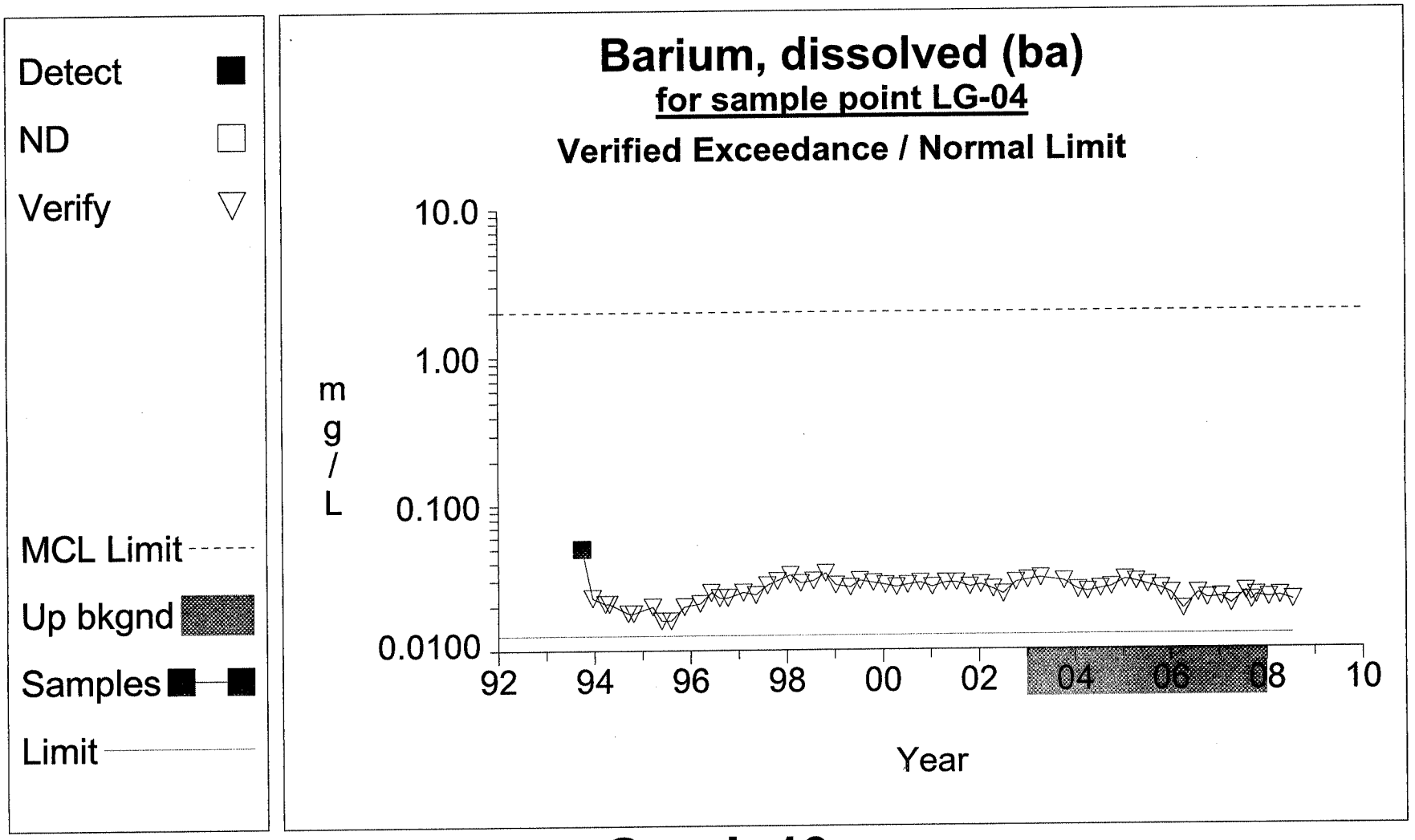
Up vs. Down Prediction Limits



Graph 3

Analysis prepared on: 1/22/2009

Up vs. Down Prediction Limits

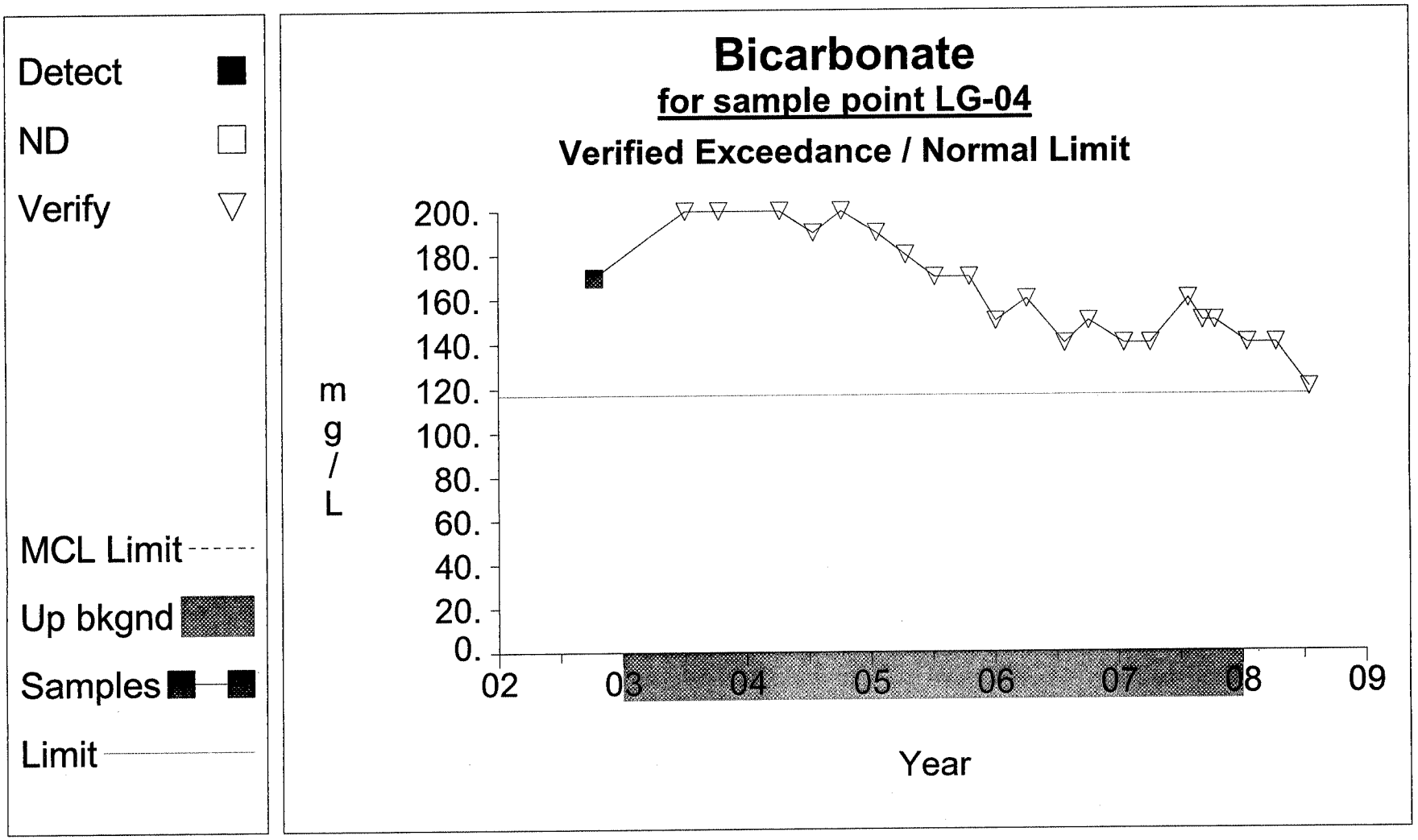


Graph 19

Prepared by: Snohomish County Solid Waste

Analysis prepared on: 1/22/2009

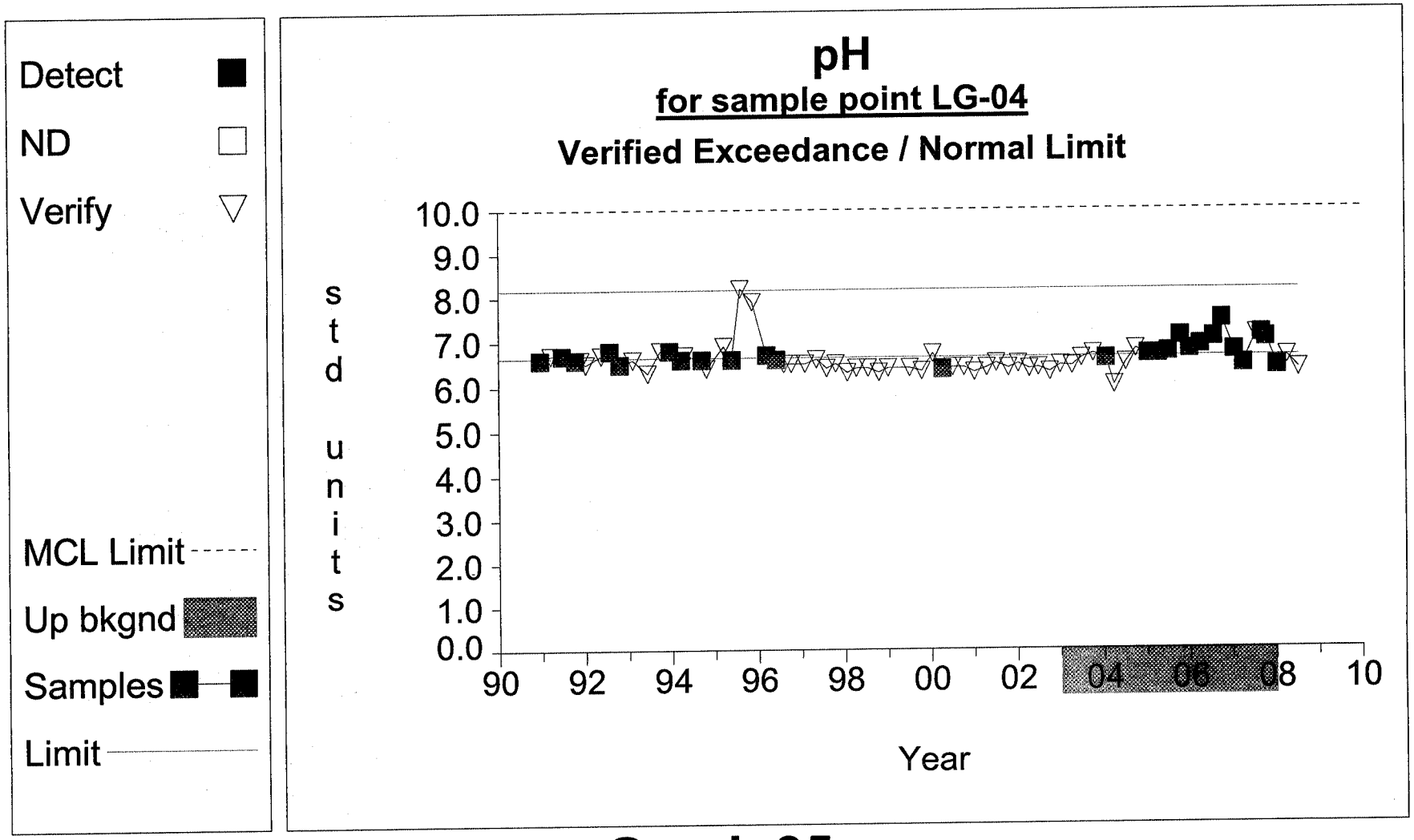
Up vs. Down Prediction Limits



Graph 27

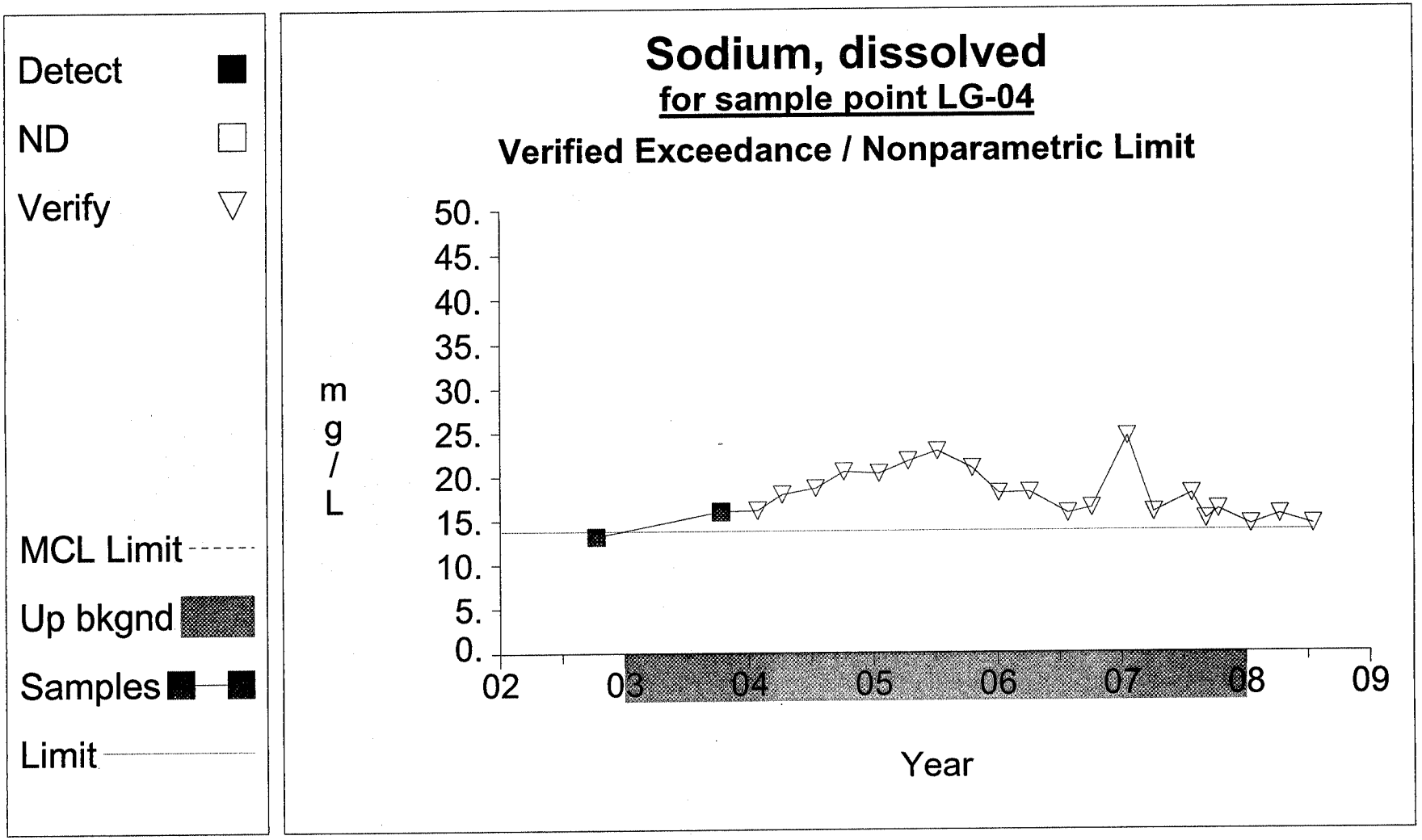
Prepared by: Snohomish County Solid Waste

Up vs. Down Prediction Limits



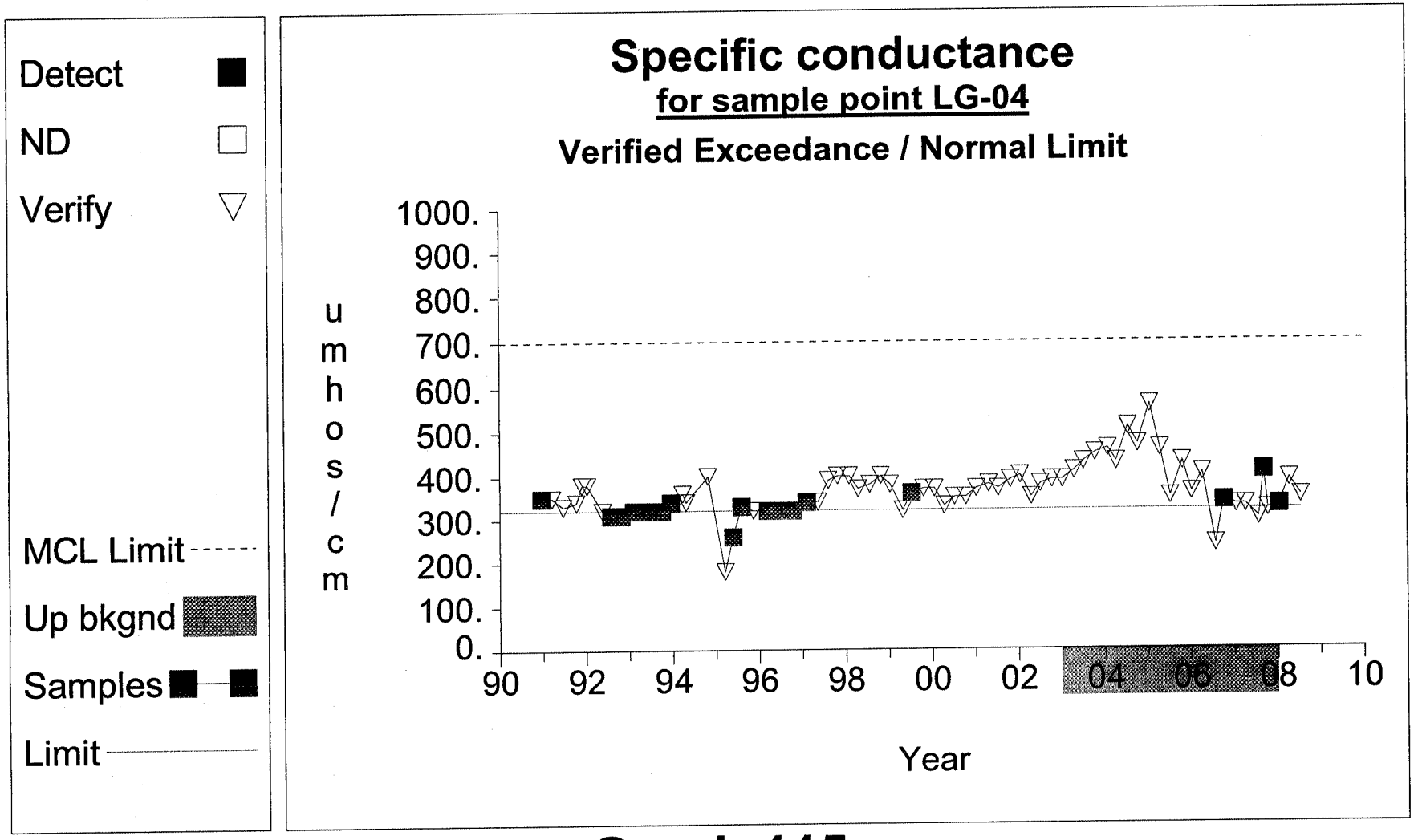
Graph 95

Up vs. Down Prediction Limits



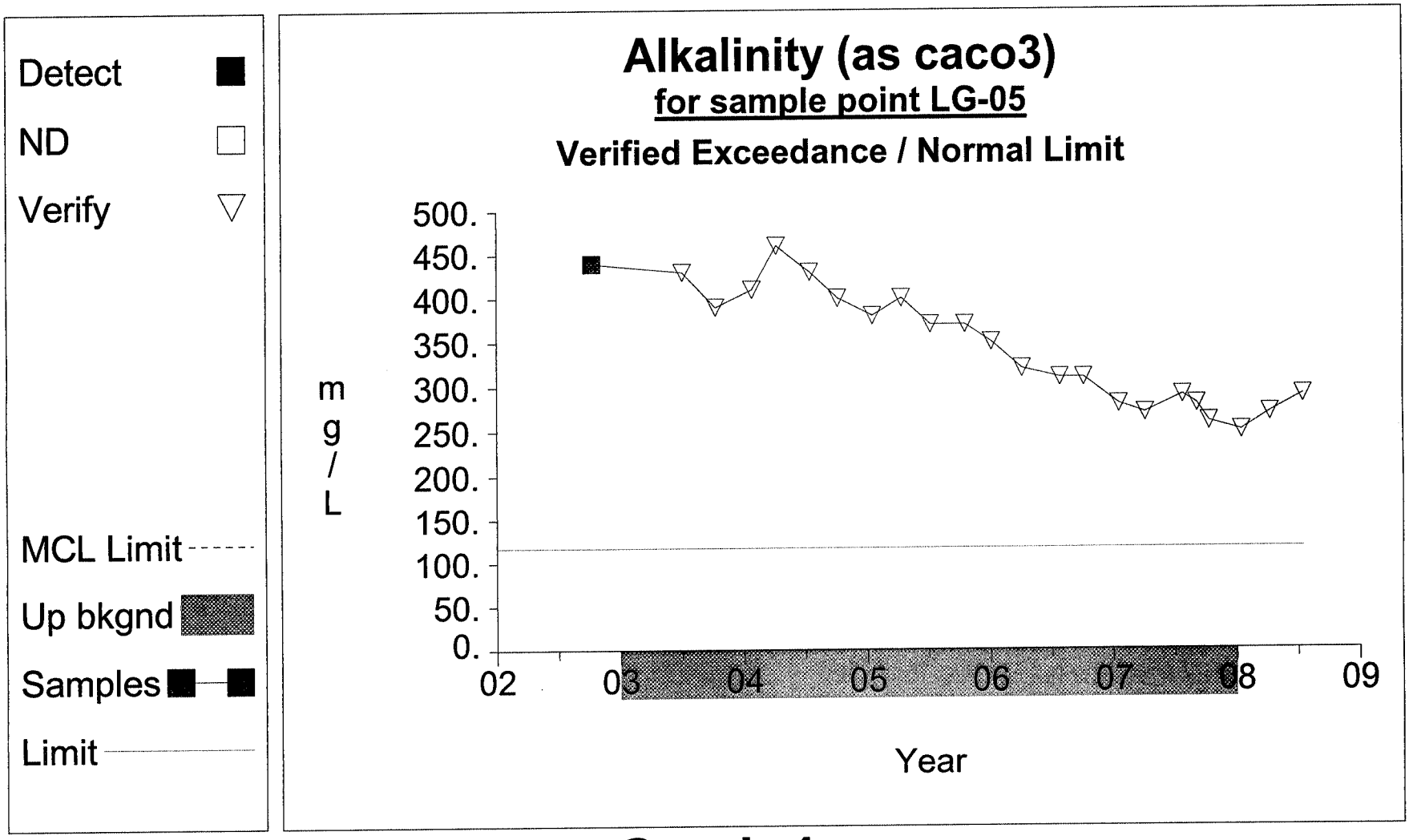
Graph 111

Up vs. Down Prediction Limits



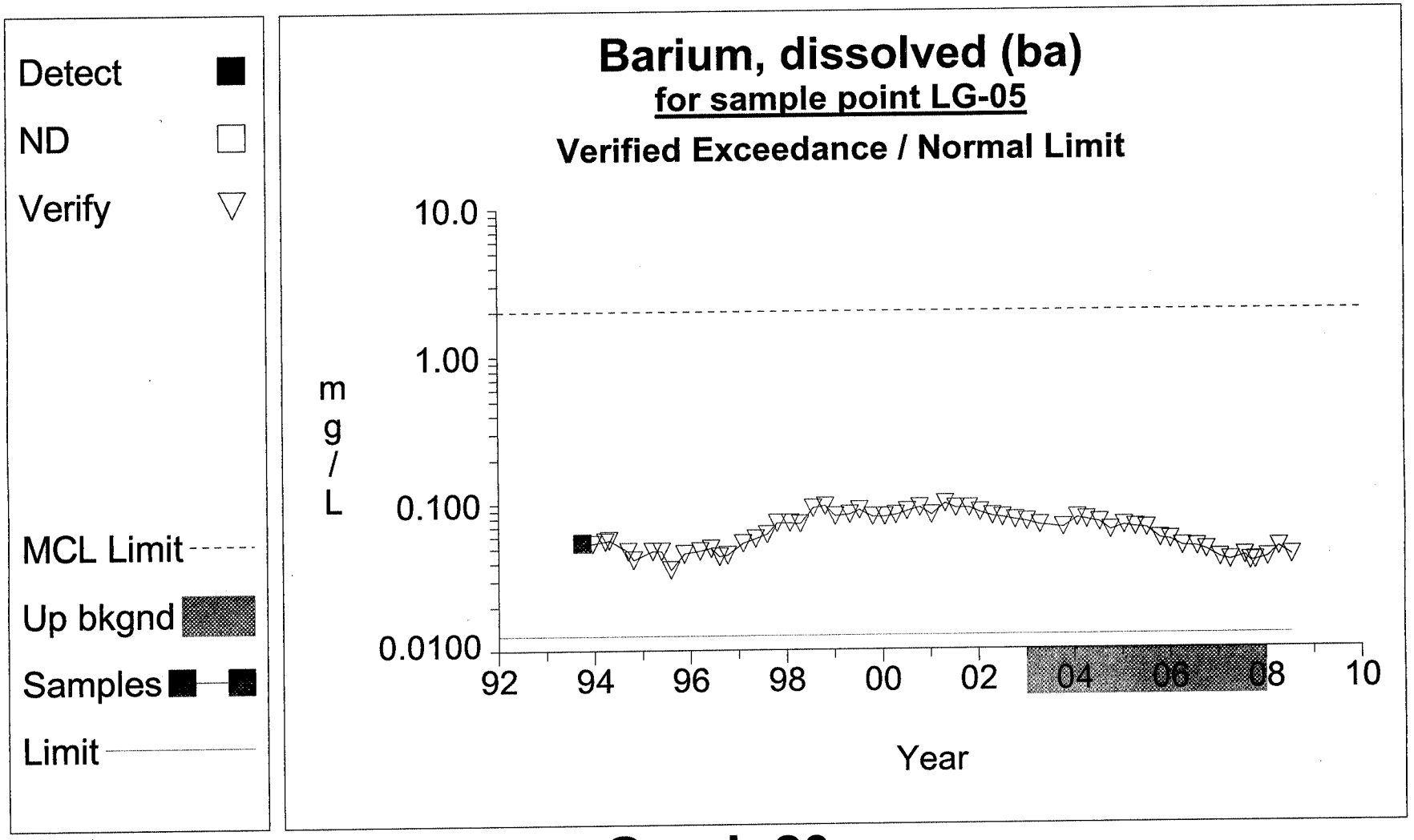
Graph 115

Up vs. Down Prediction Limits



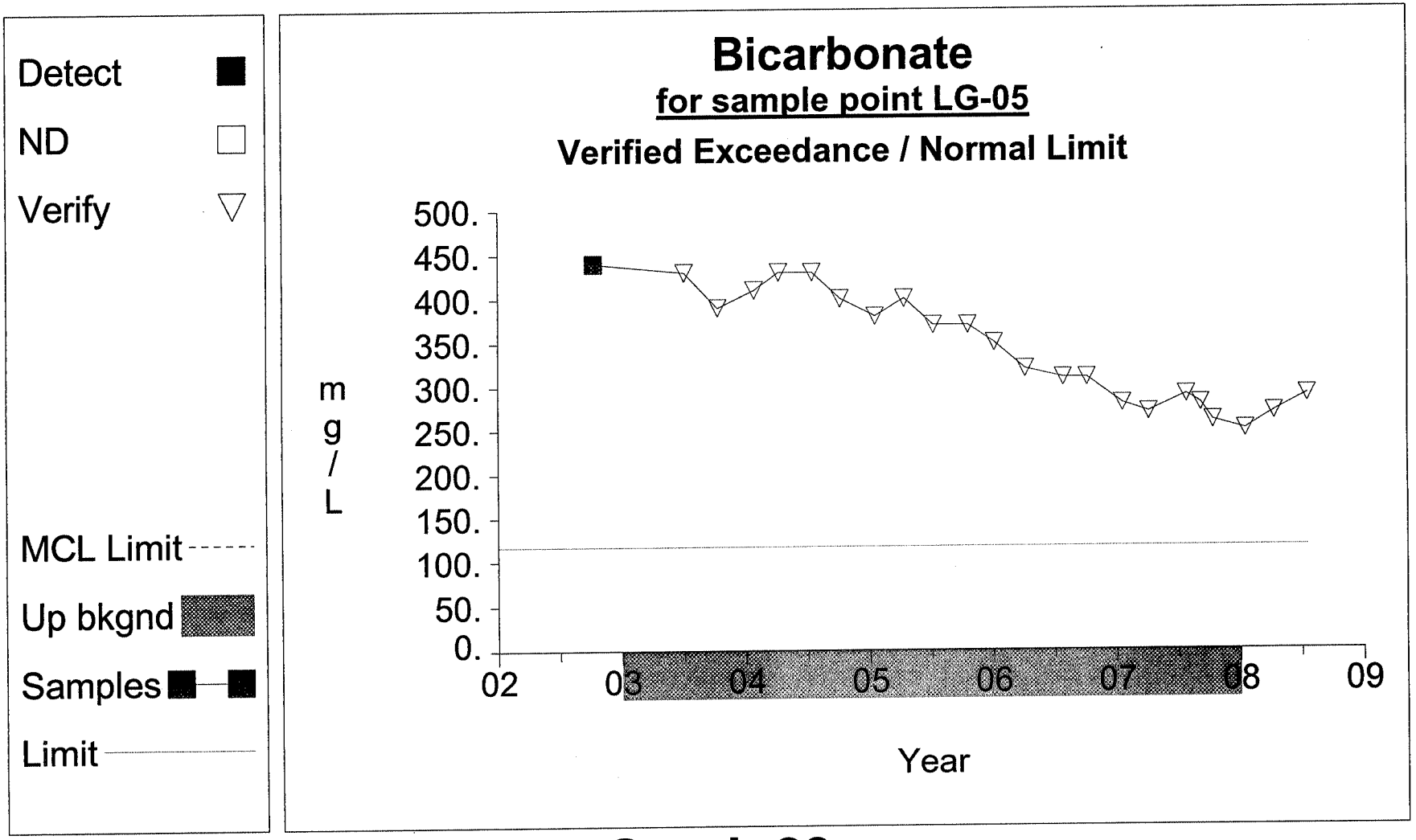
Graph 4

Up vs. Down Prediction Limits



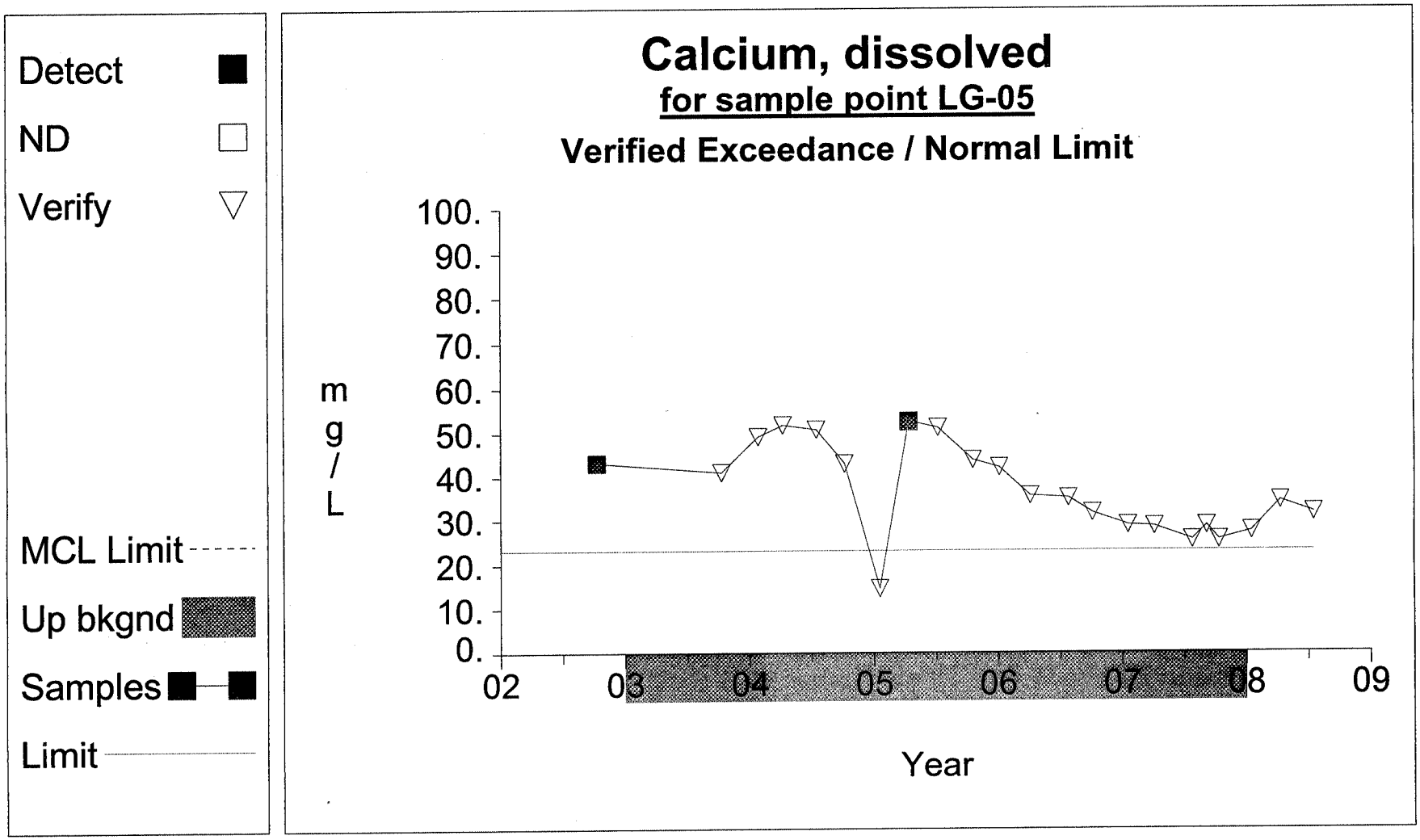
Graph 20

Up vs. Down Prediction Limits



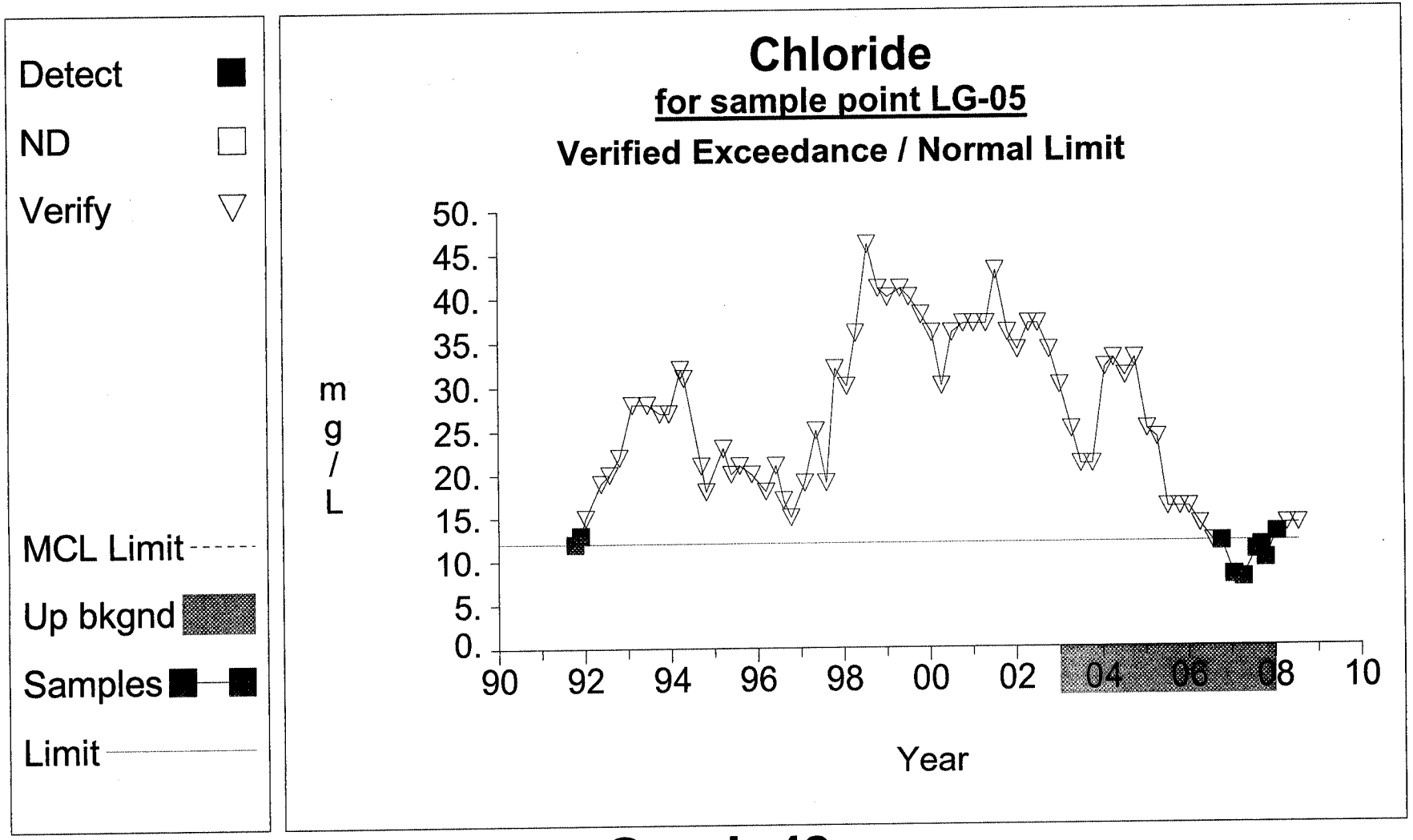
Graph 28

Up vs. Down Prediction Limits



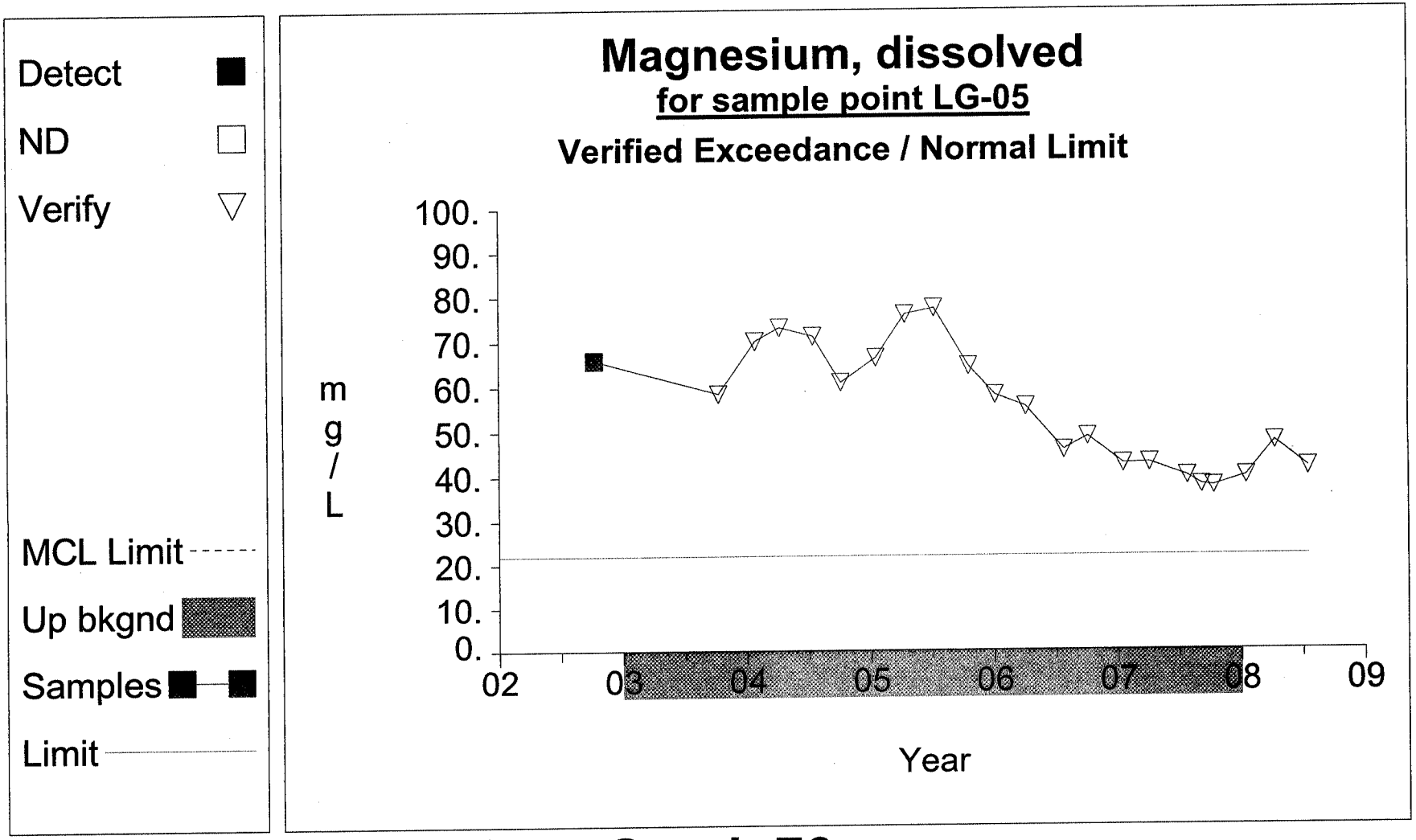
Graph 40

Up vs. Down Prediction Limits



Graph 48

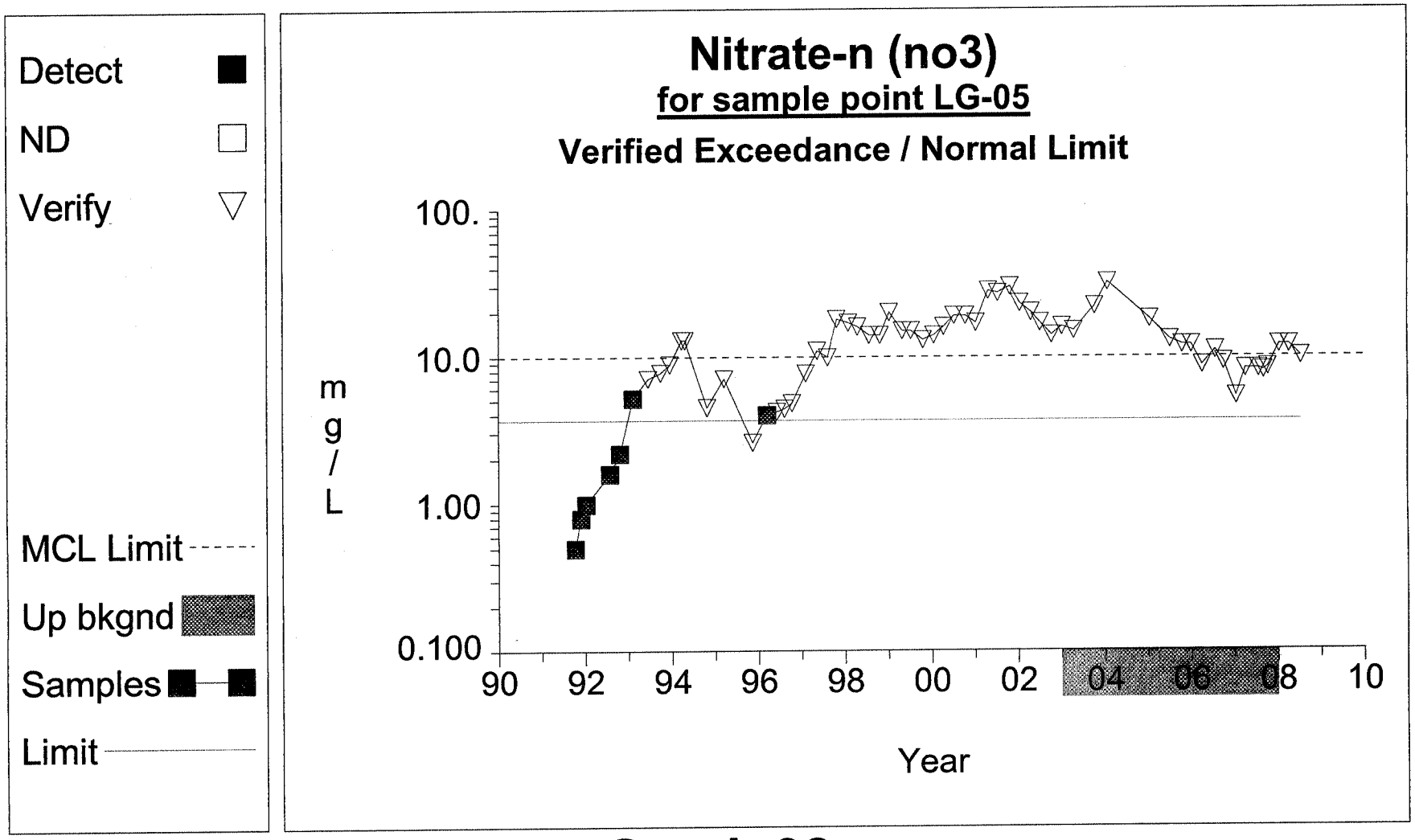
Up vs. Down Prediction Limits



Graph 76

Analysis prepared on: 1/22/2009

Up vs. Down Prediction Limits

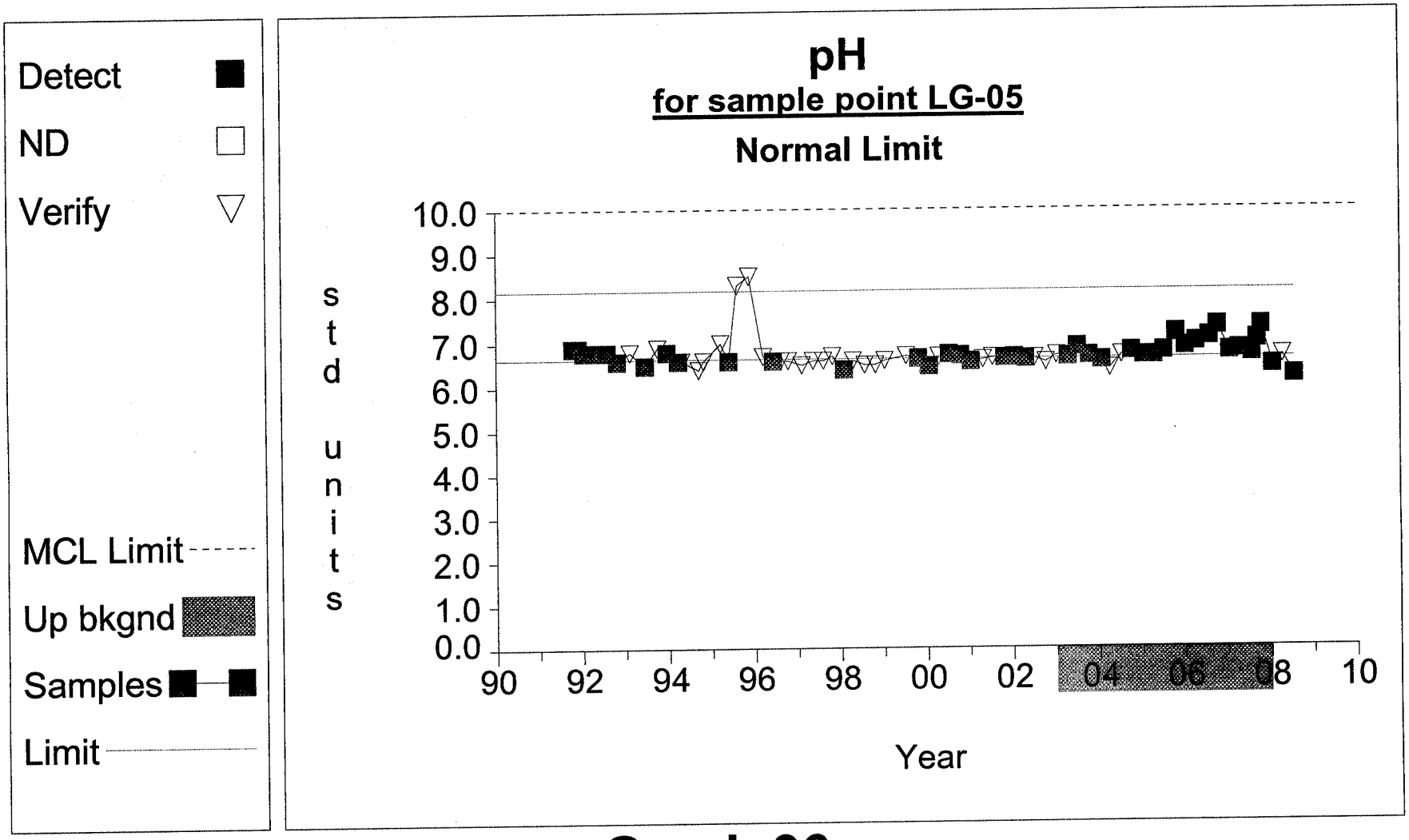


Graph 92

Prepared by: Snohomish County Solid Waste

Analysis prepared on: 1/22/2009

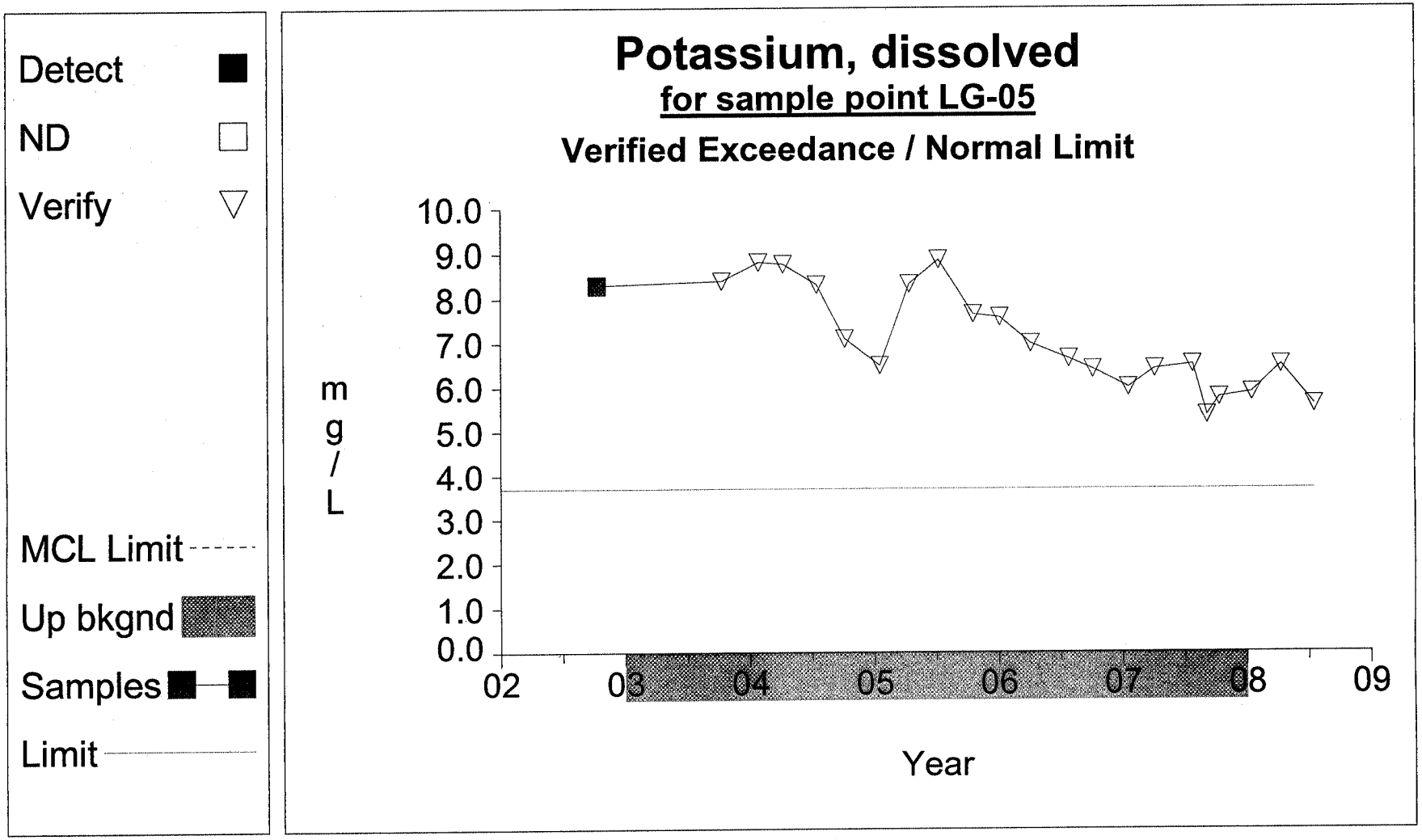
Up vs. Down Prediction Limits



Graph 96

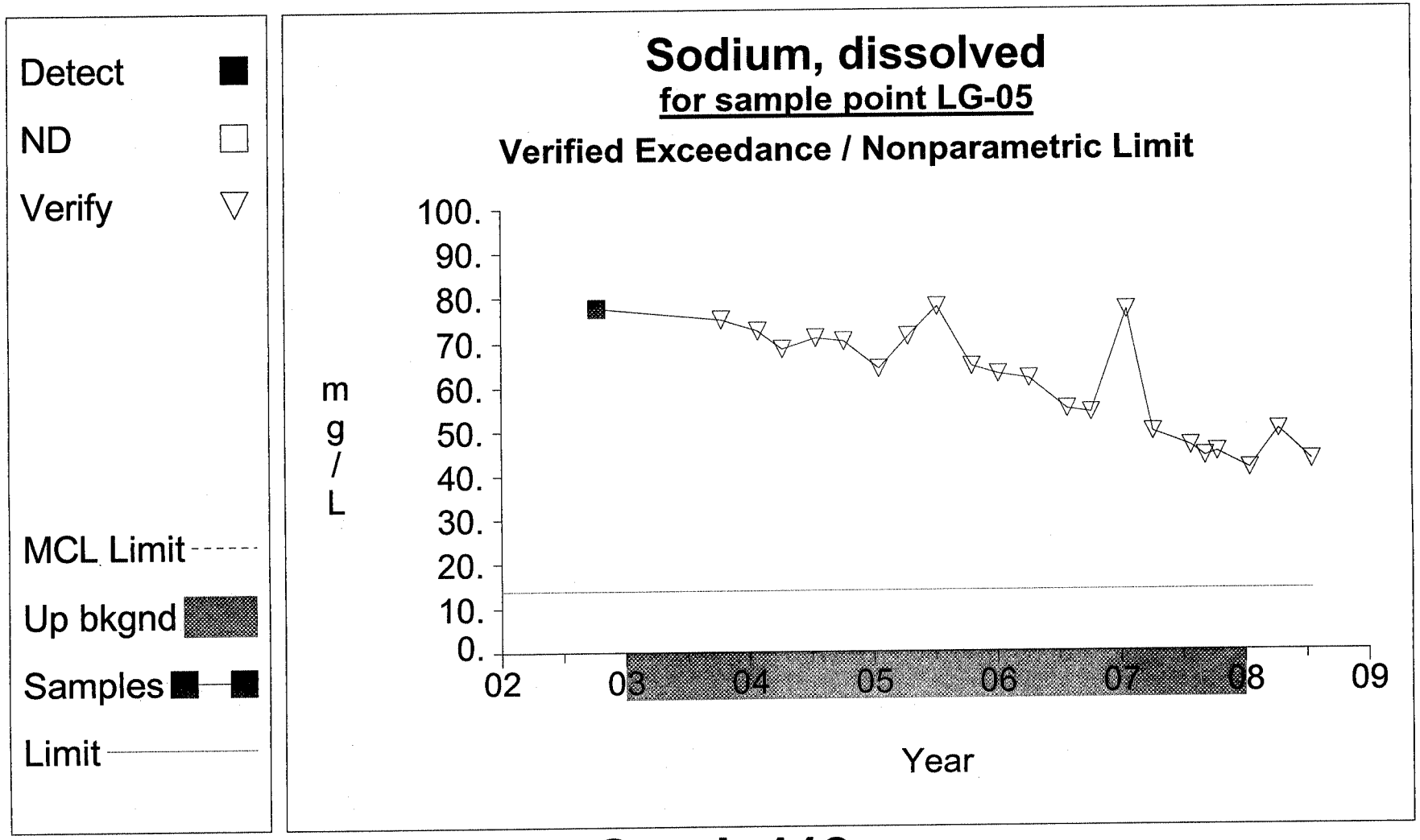
Prepared by: Snohomish County Solid Waste

Up vs. Down Prediction Limits



Graph 100

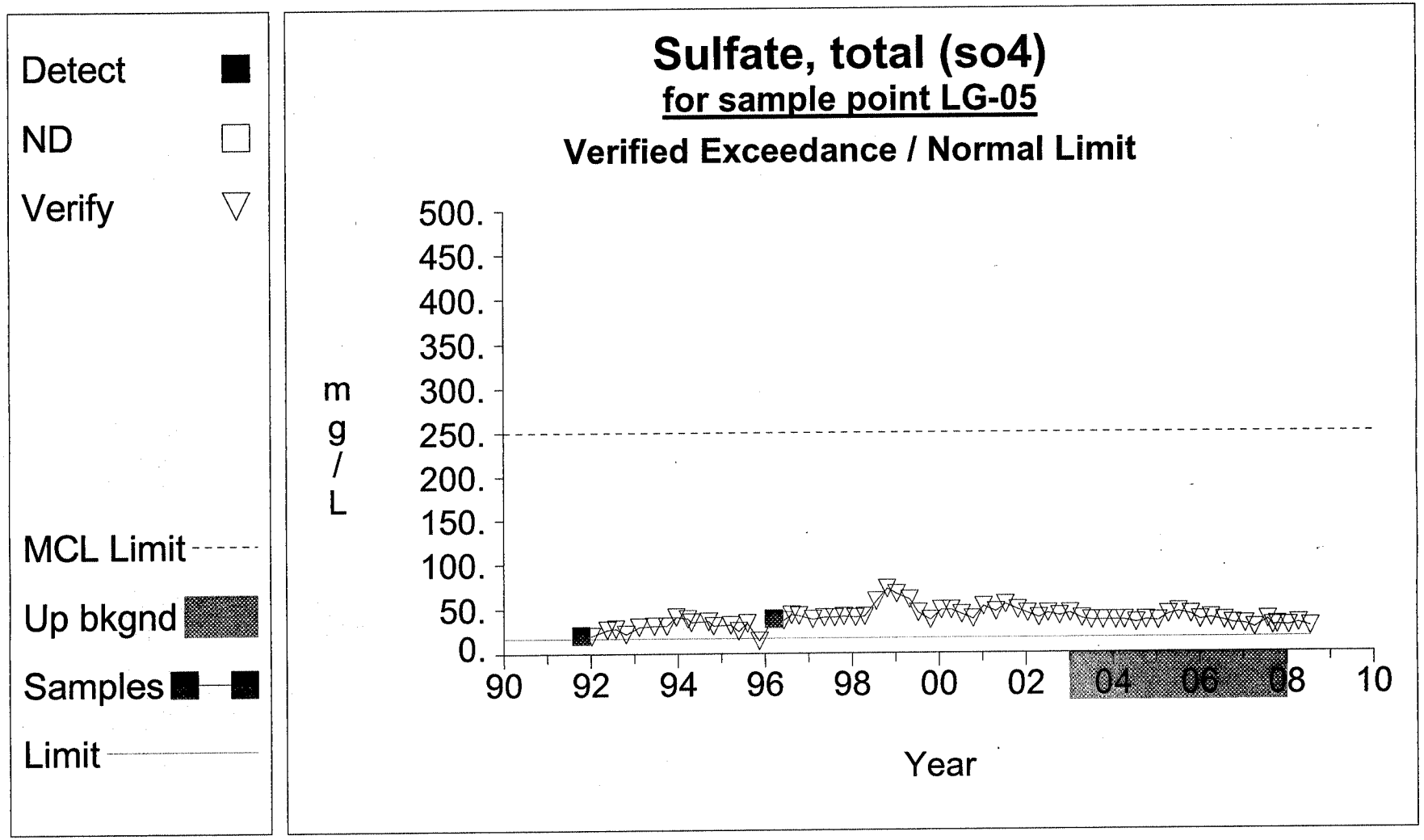
Up vs. Down Prediction Limits



Graph 112

Analysis prepared on: 1/22/2009

Up vs. Down Prediction Limits

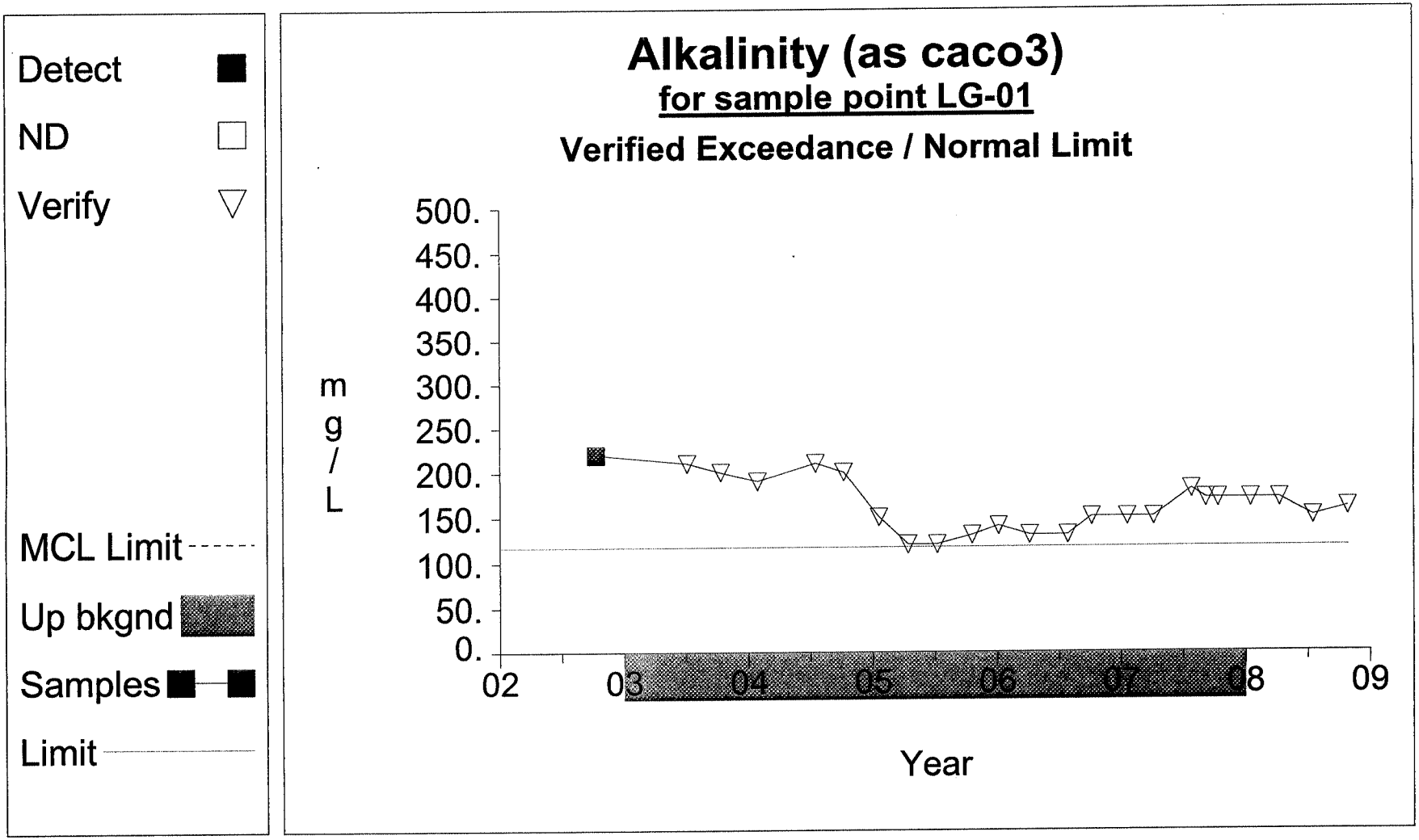


Graph 120

Prepared by: Snohomish County Solid Waste

4TH QUARTER

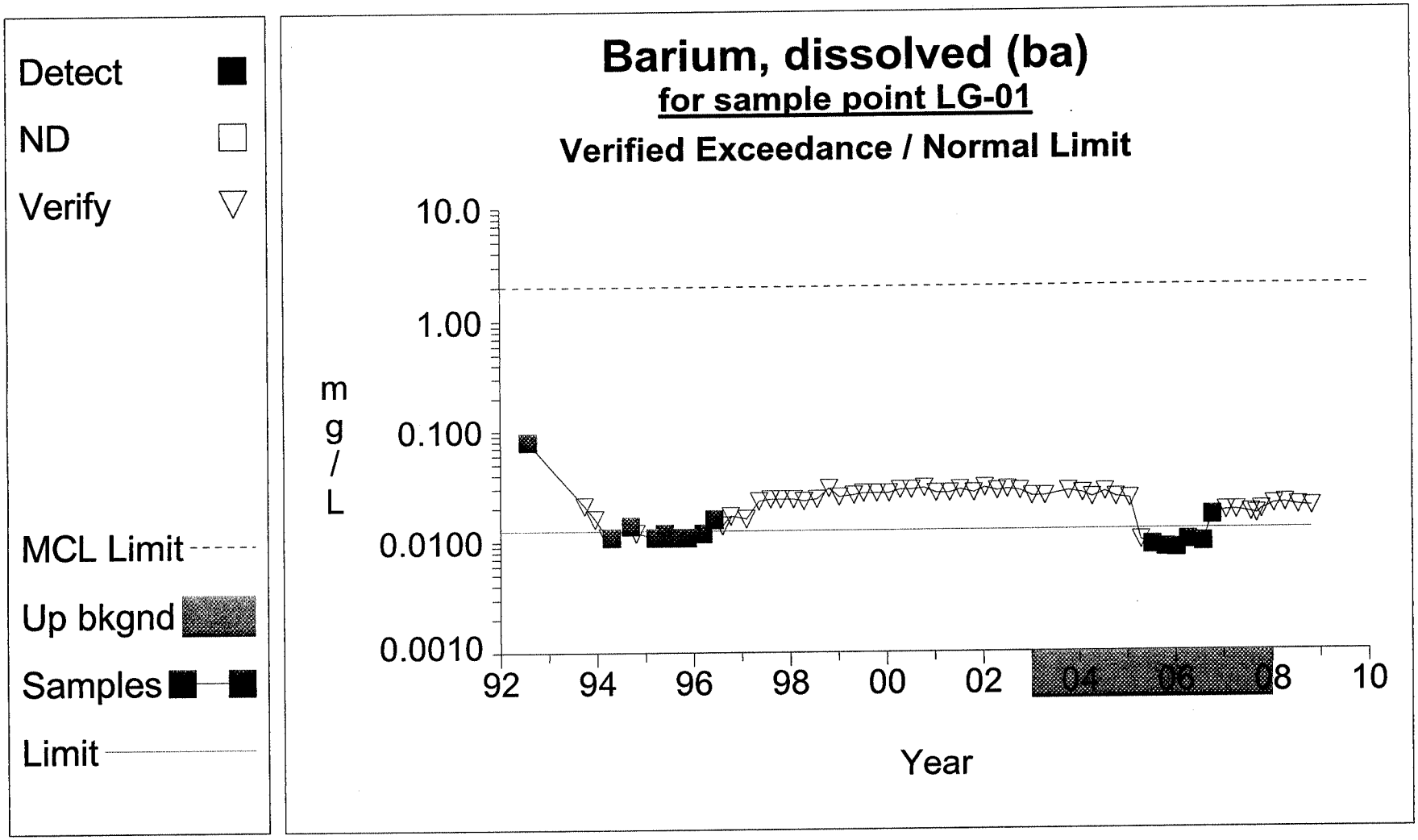
Up vs. Down Prediction Limits



Graph 1

Analysis prepared on: 1/22/2009

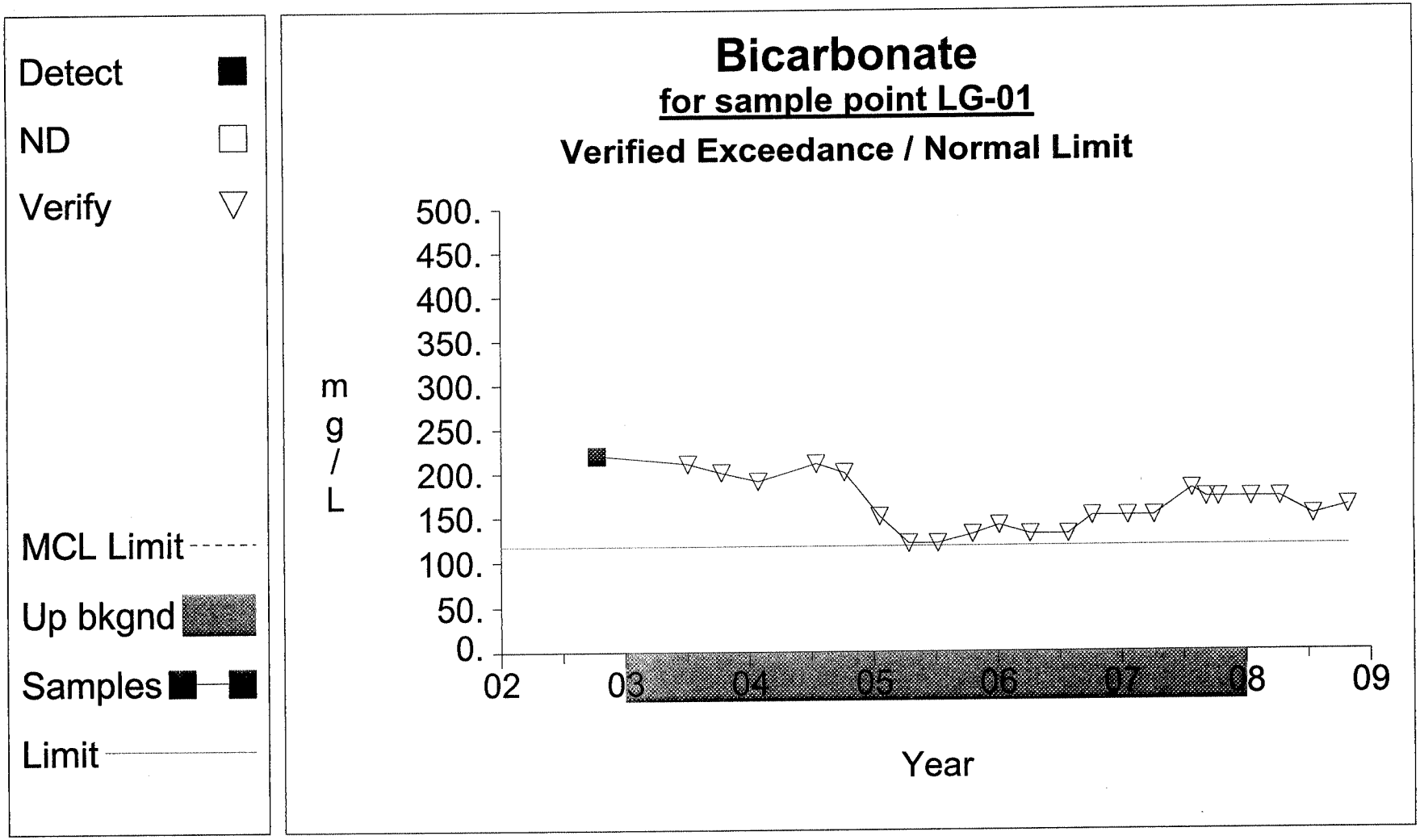
Up vs. Down Prediction Limits



Graph 17

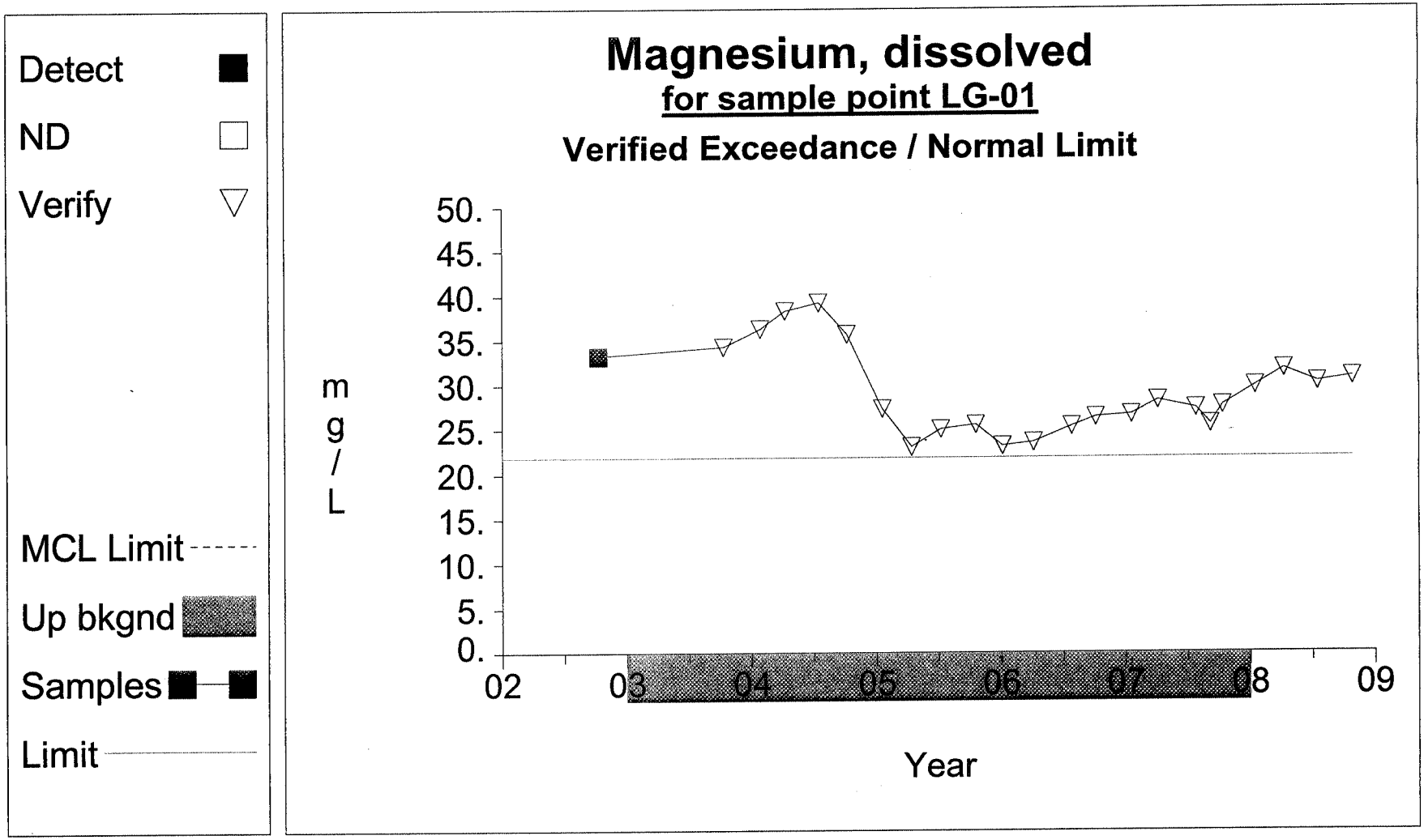
Prepared by: Snohomish County Solid Waste

Up vs. Down Prediction Limits



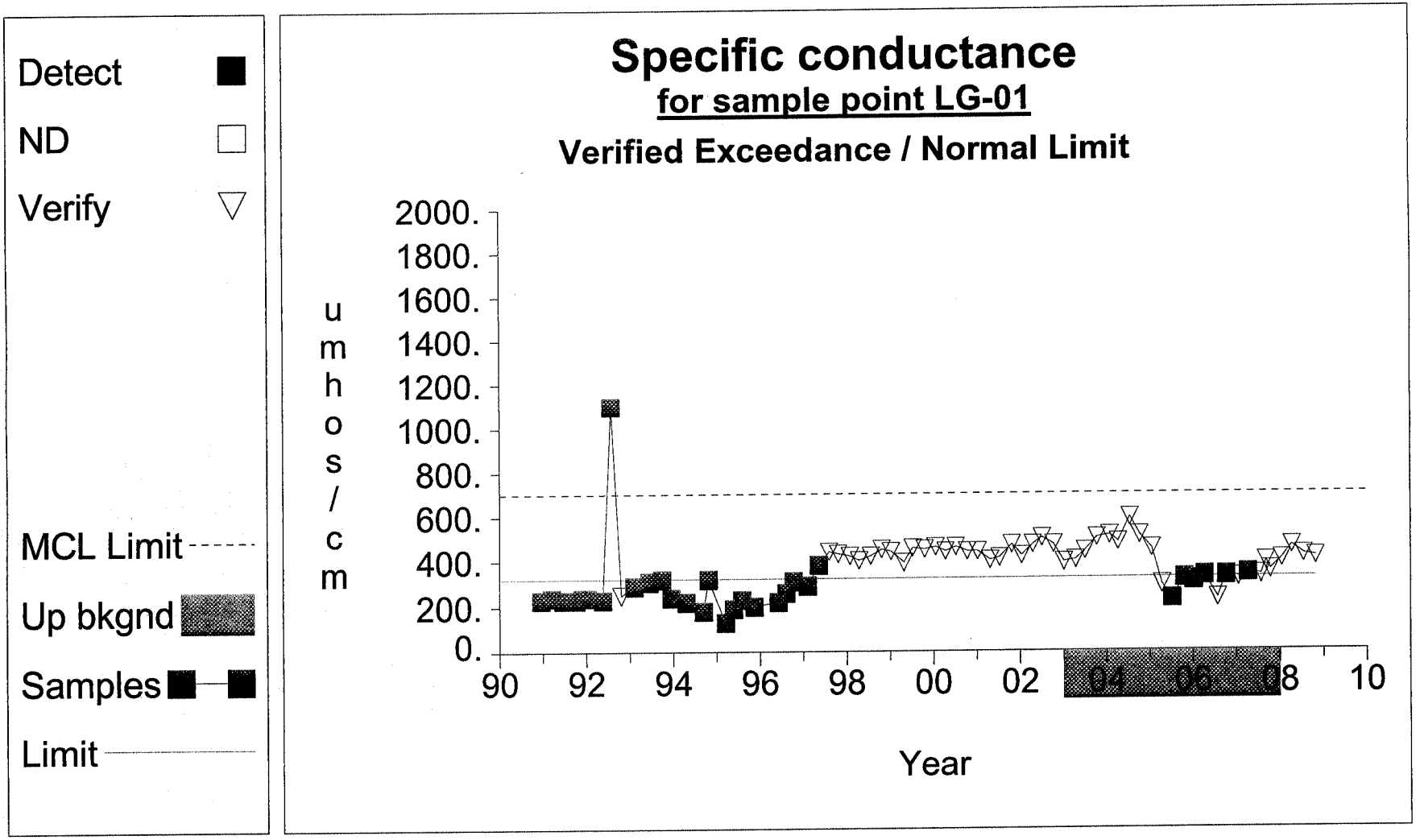
Graph 25

Up vs. Down Prediction Limits



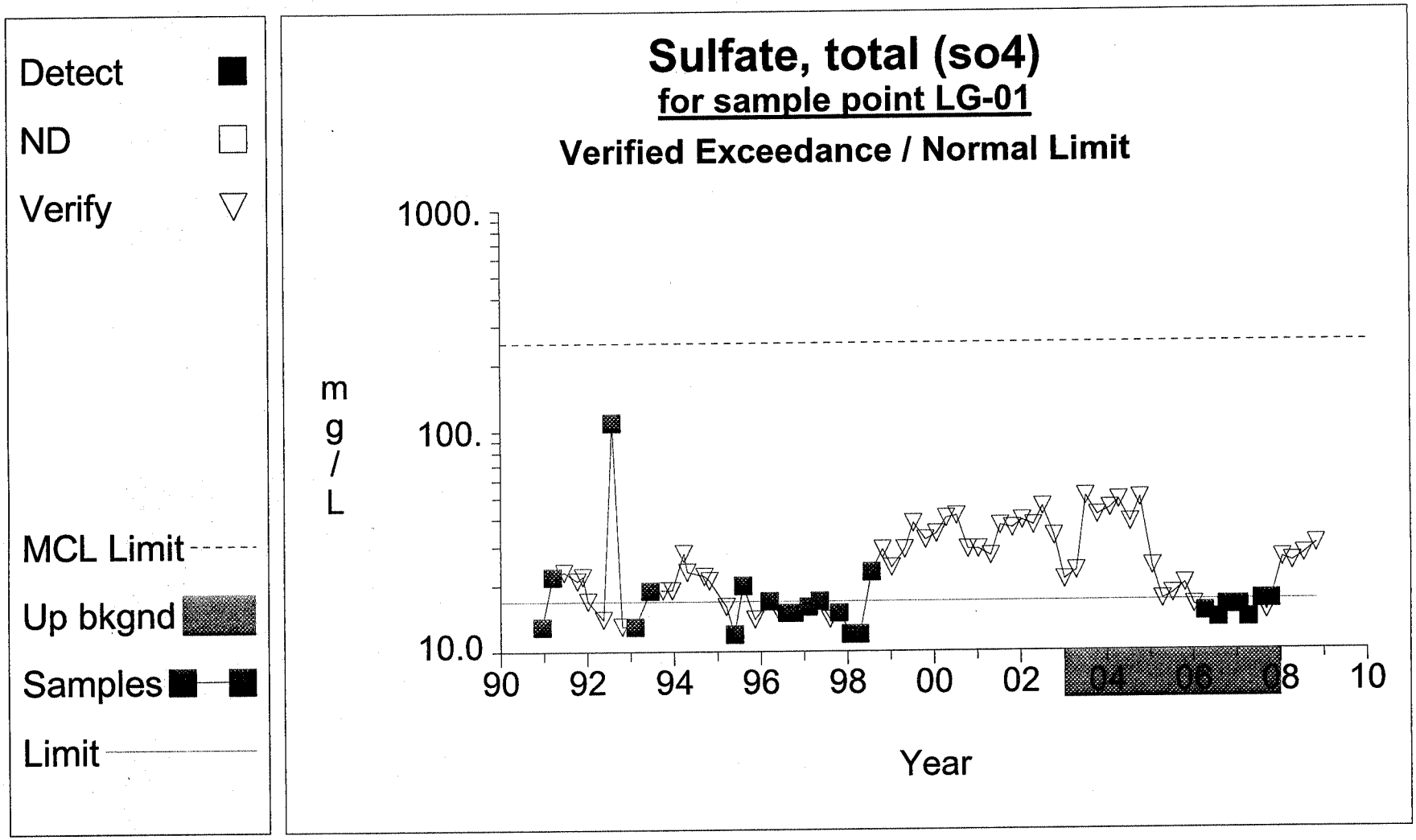
Graph 73

Up vs. Down Prediction Limits



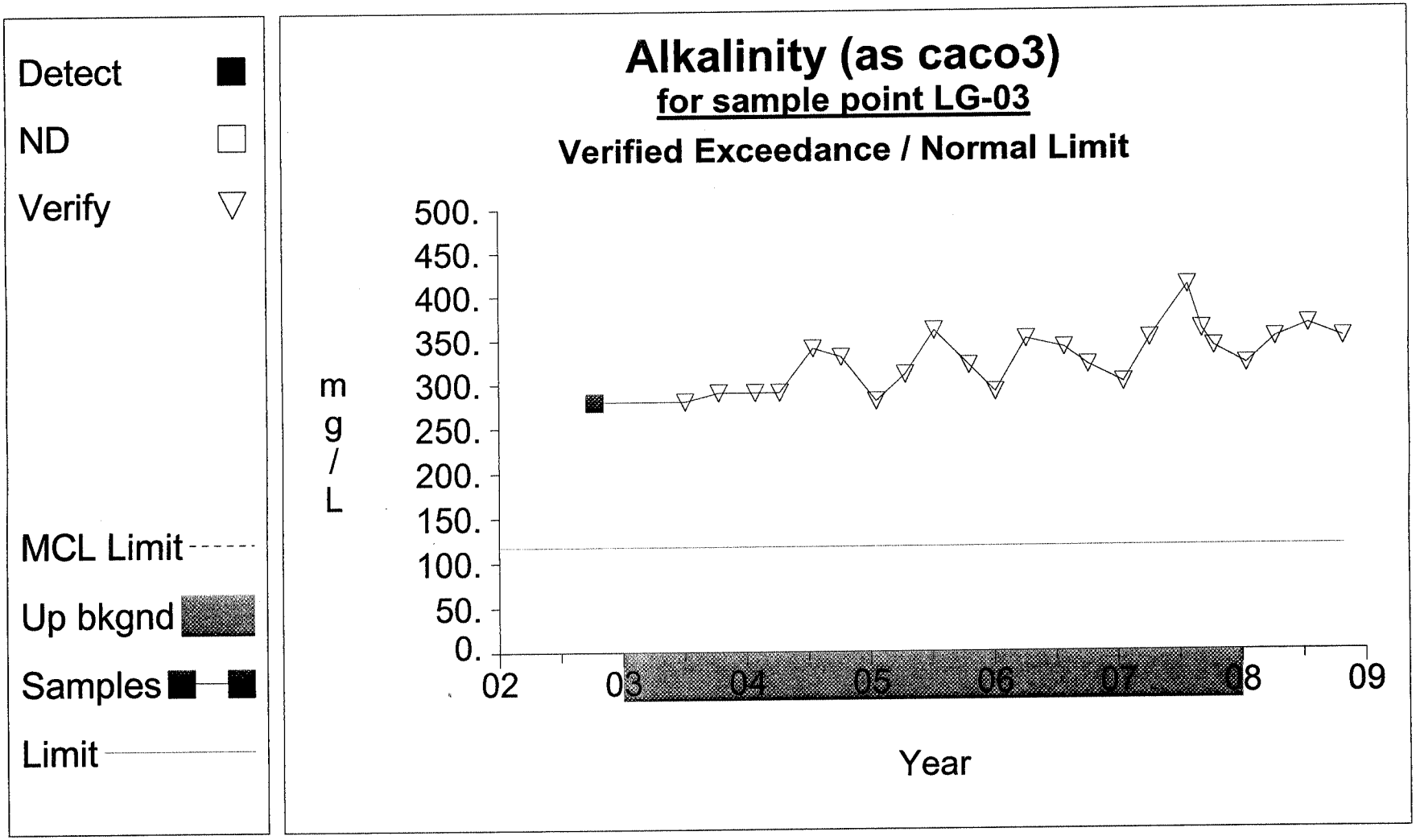
Graph 113

Up vs. Down Prediction Limits



Graph 117

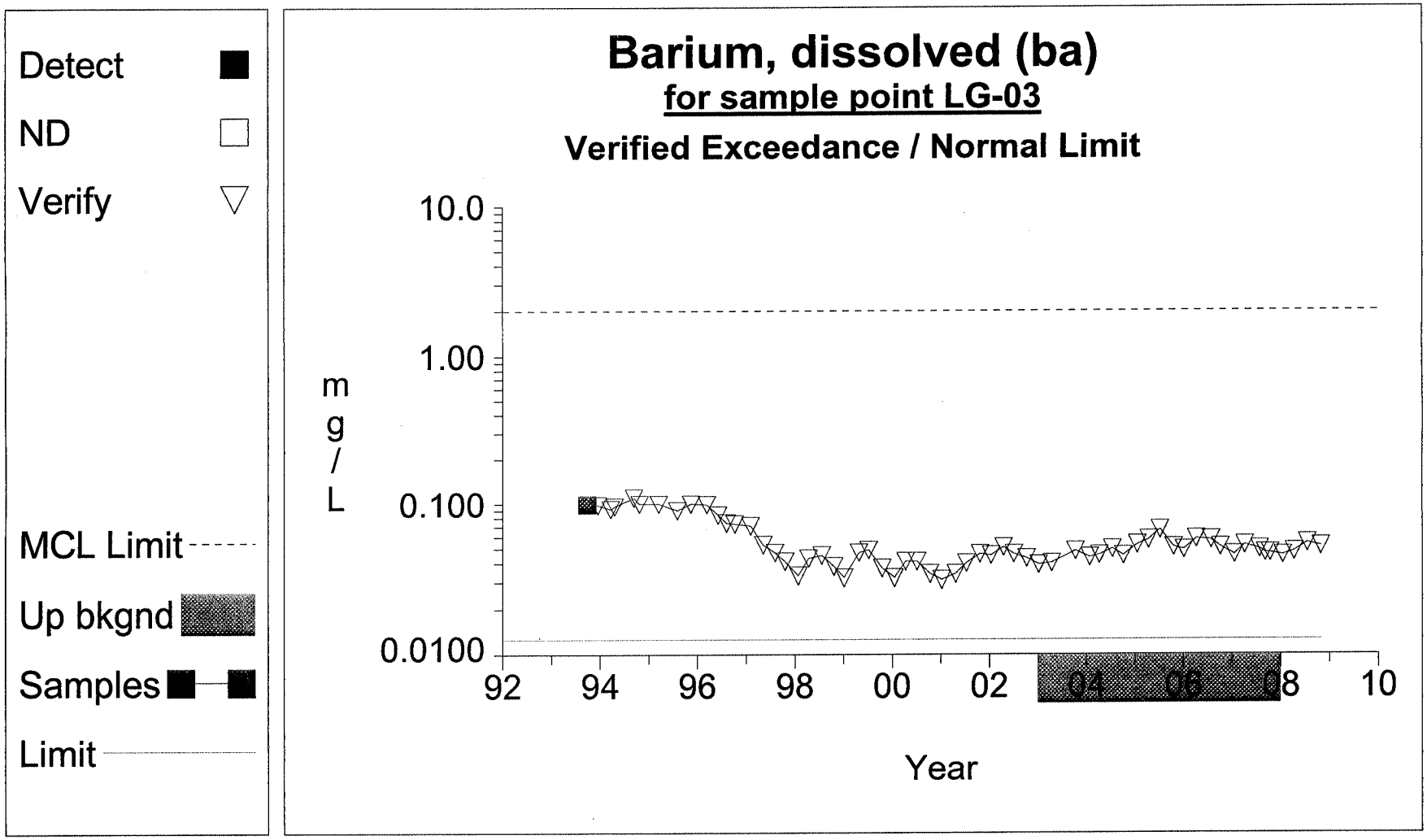
Up vs. Down Prediction Limits



Graph 2

Analysis prepared on: 1/22/2009

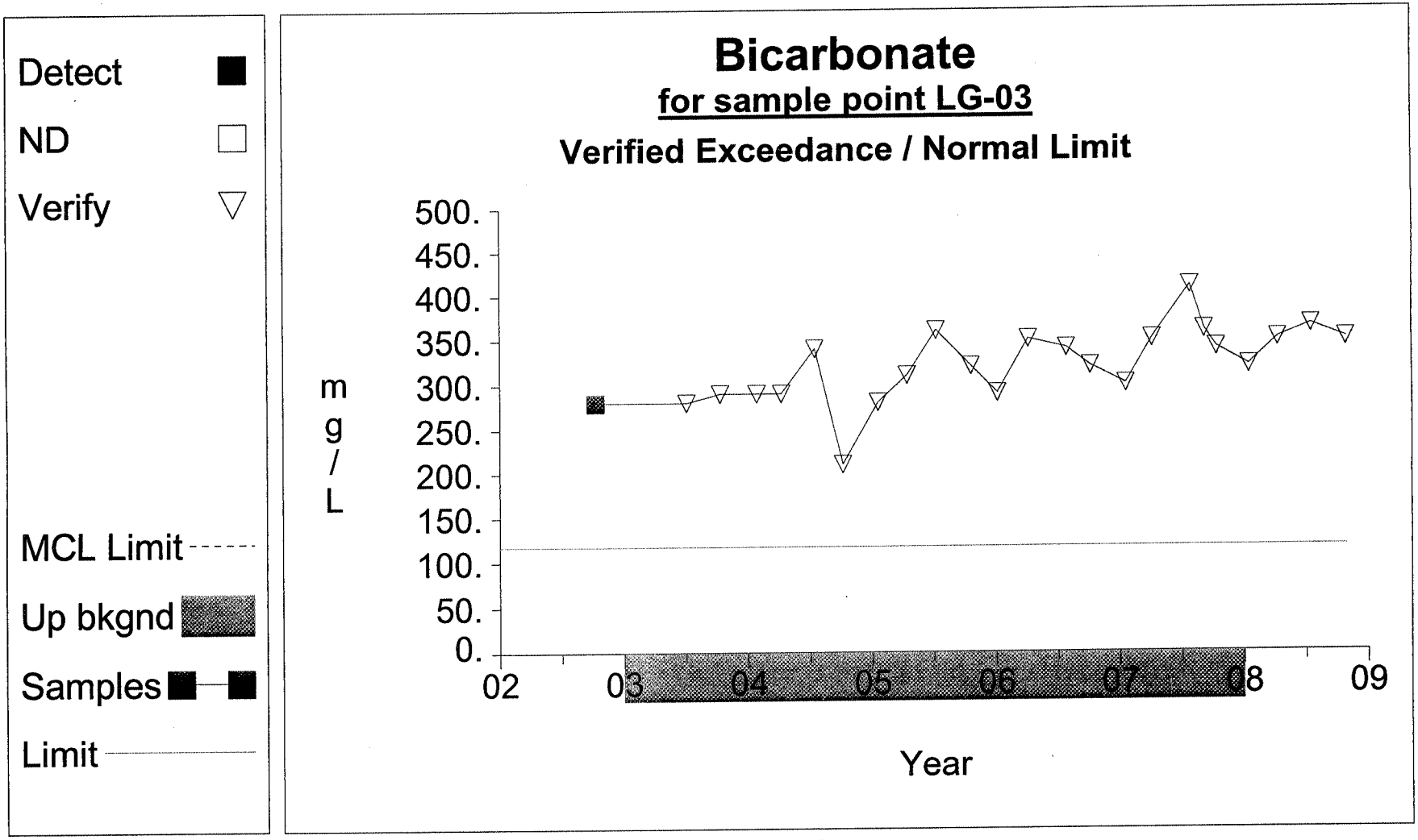
Up vs. Down Prediction Limits



Graph 18

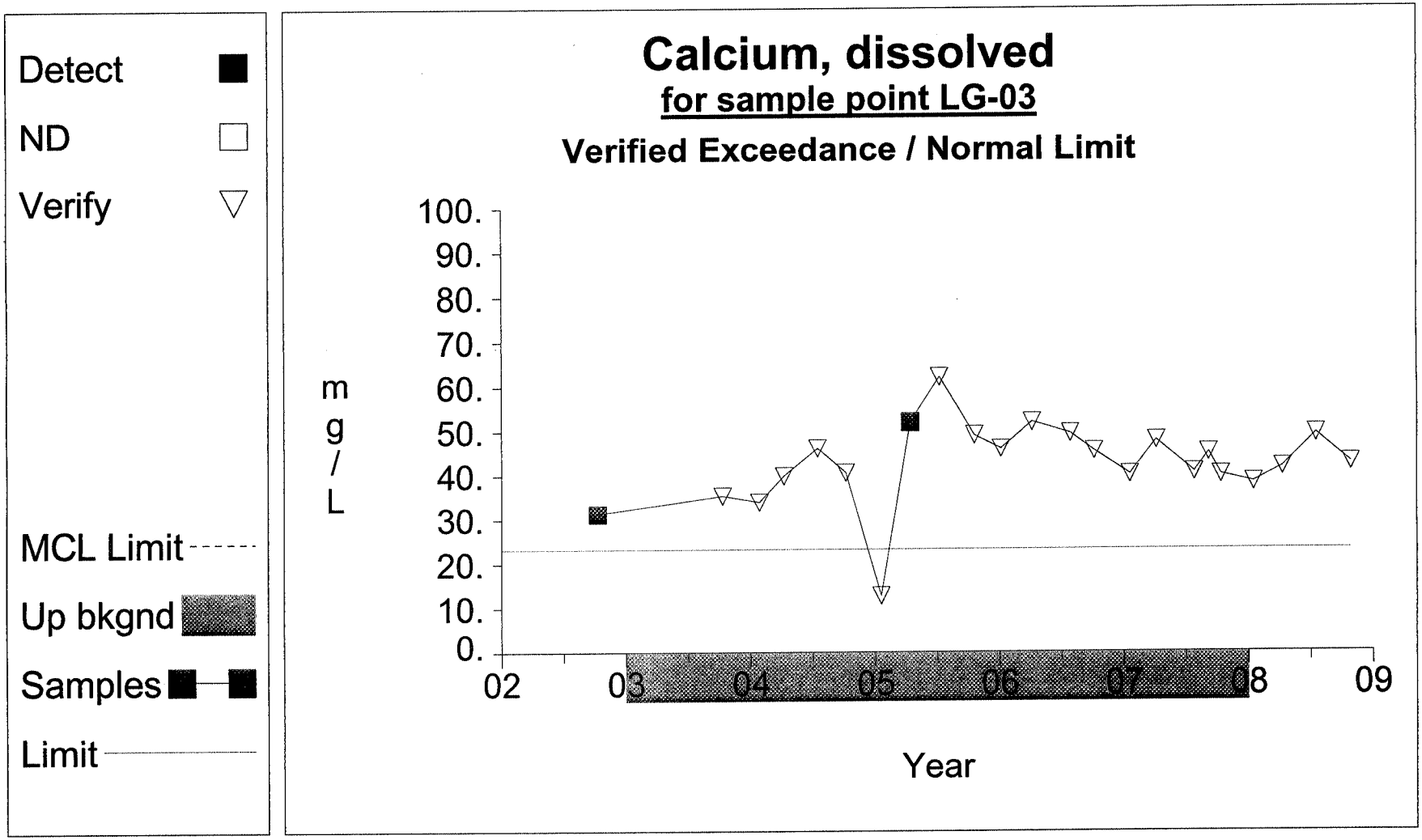
Prepared by: Snohomish County Solid Waste

Up vs. Down Prediction Limits



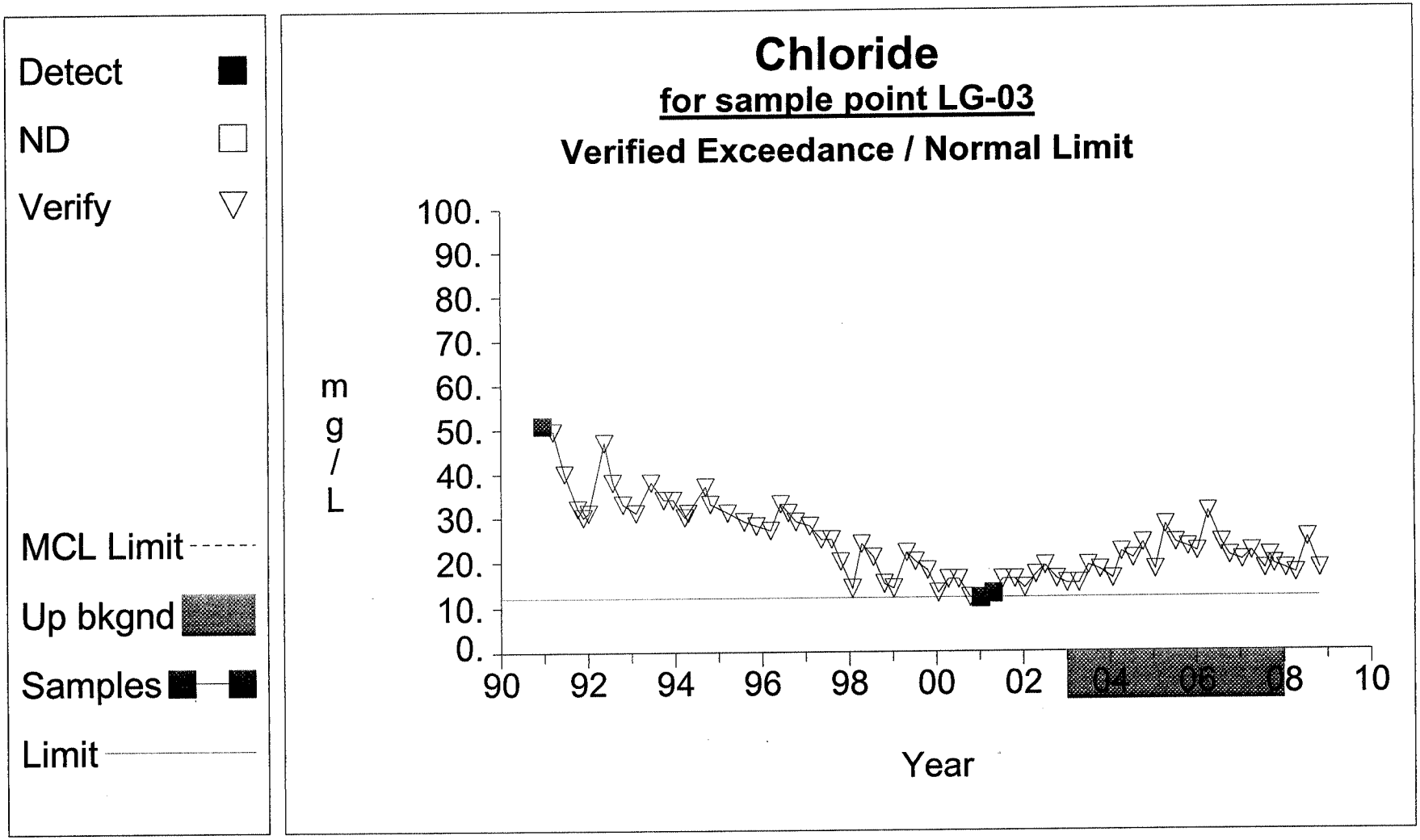
Graph 26

Up vs. Down Prediction Limits



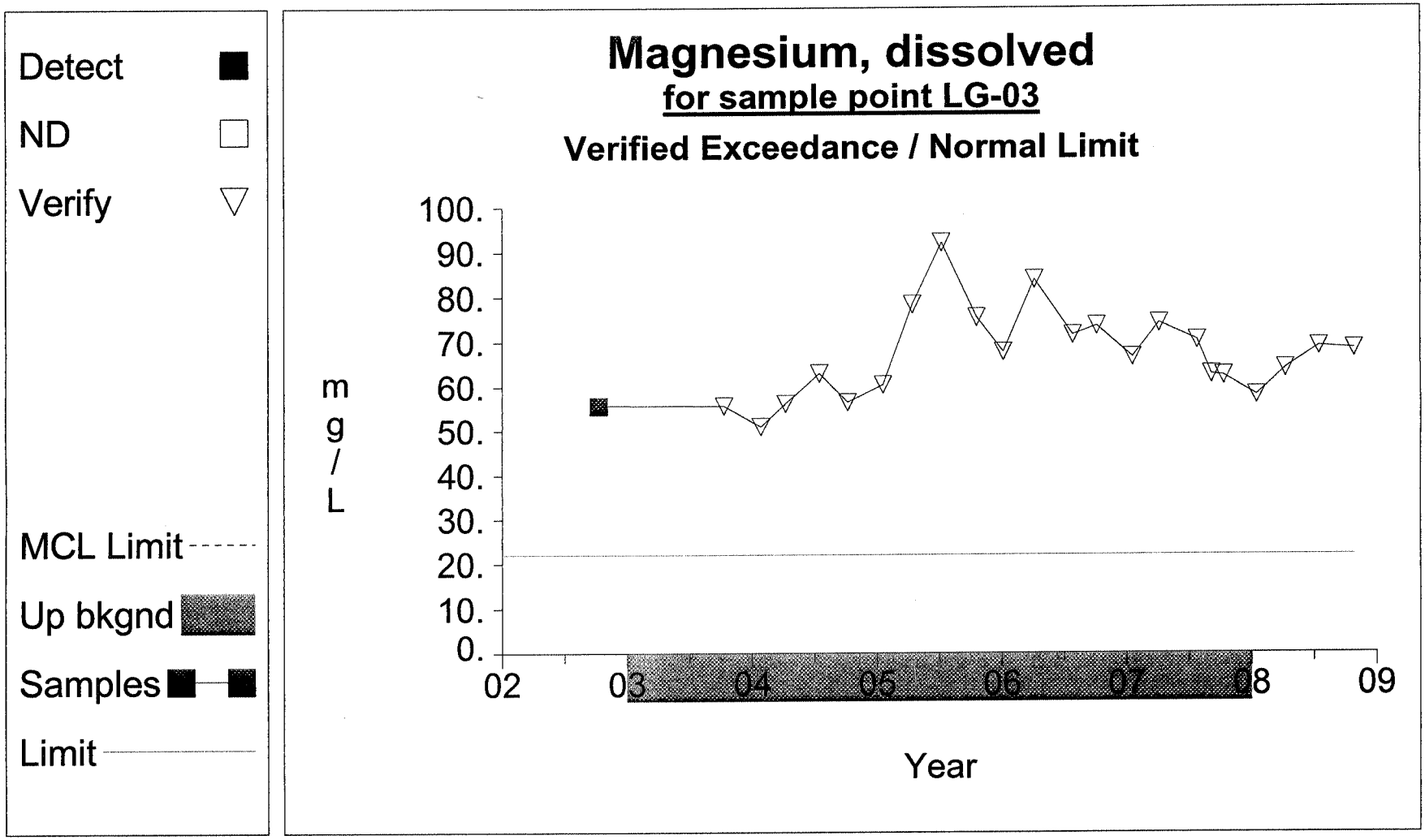
Graph 38

Up vs. Down Prediction Limits



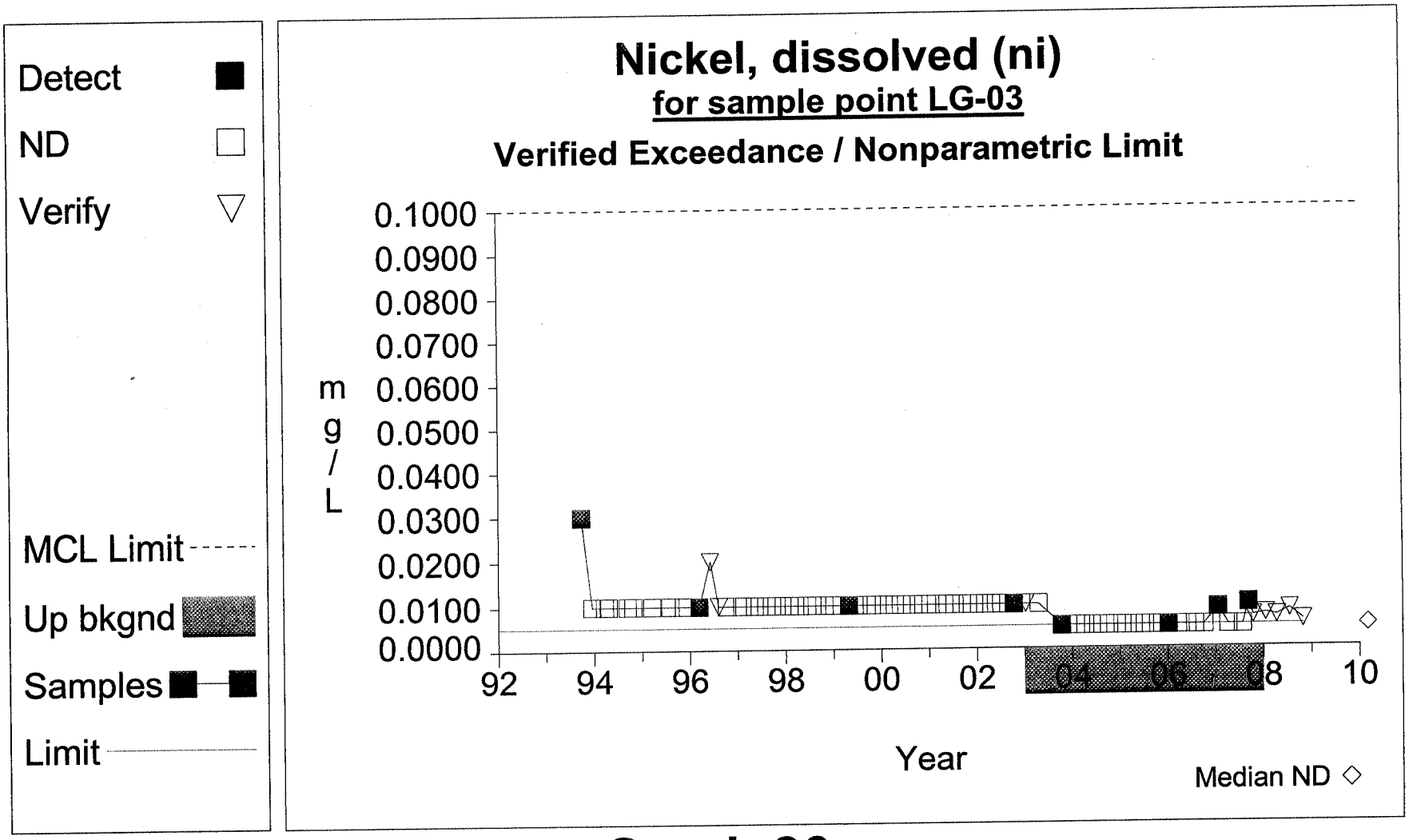
Graph 46

Up vs. Down Prediction Limits



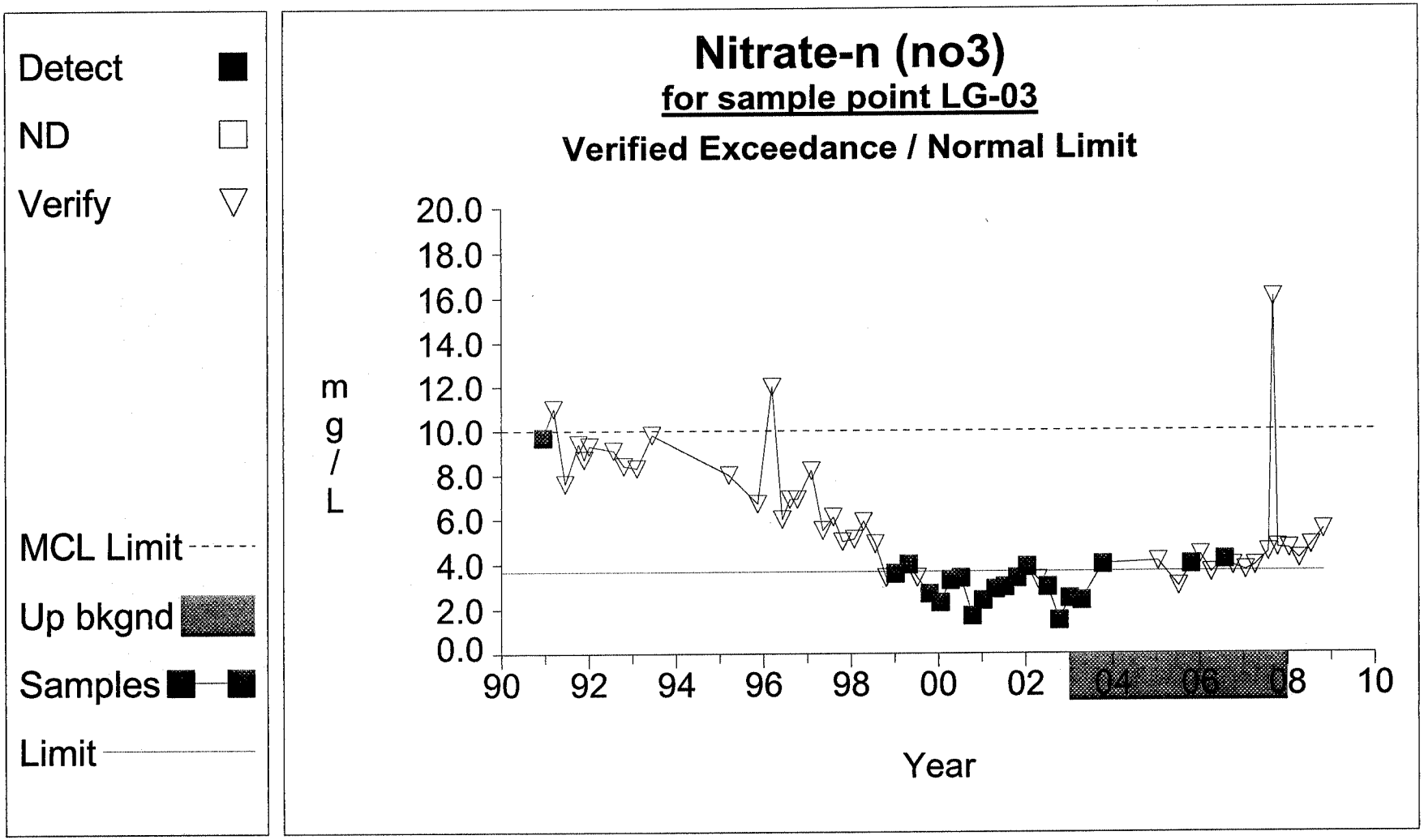
Graph 74

Up vs. Down Prediction Limits



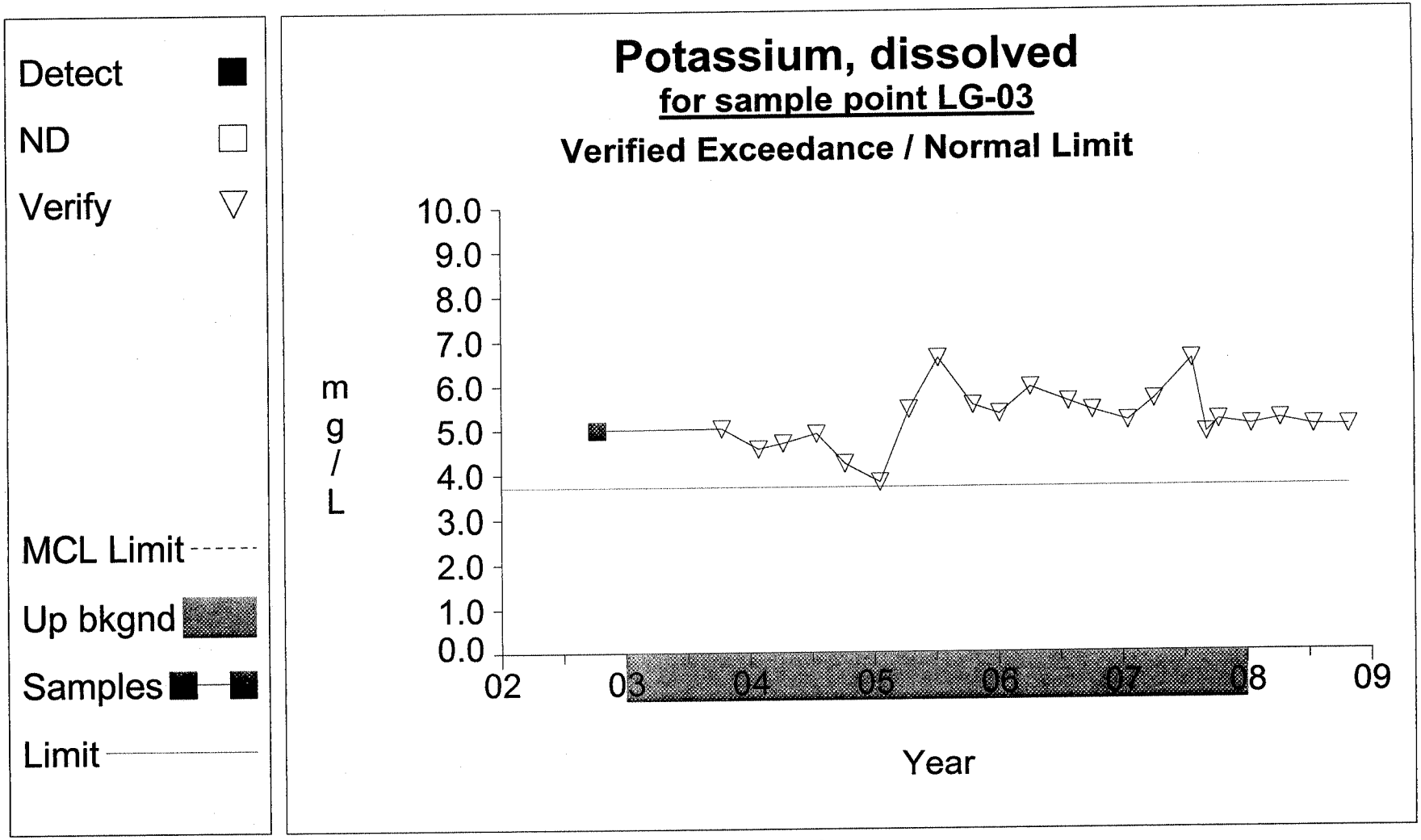
Graph 86

Up vs. Down Prediction Limits



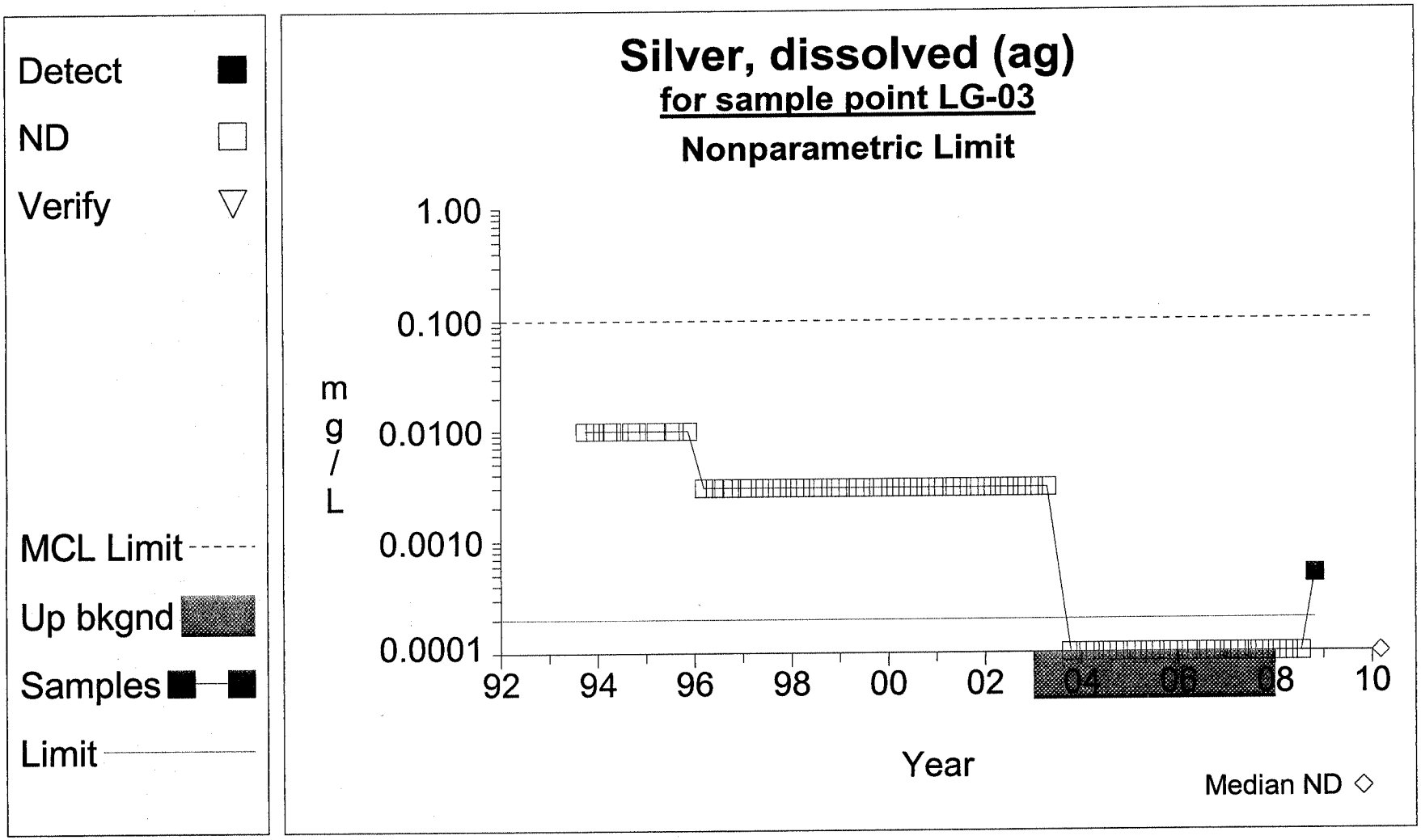
Graph 90

Up vs. Down Prediction Limits



Graph 98

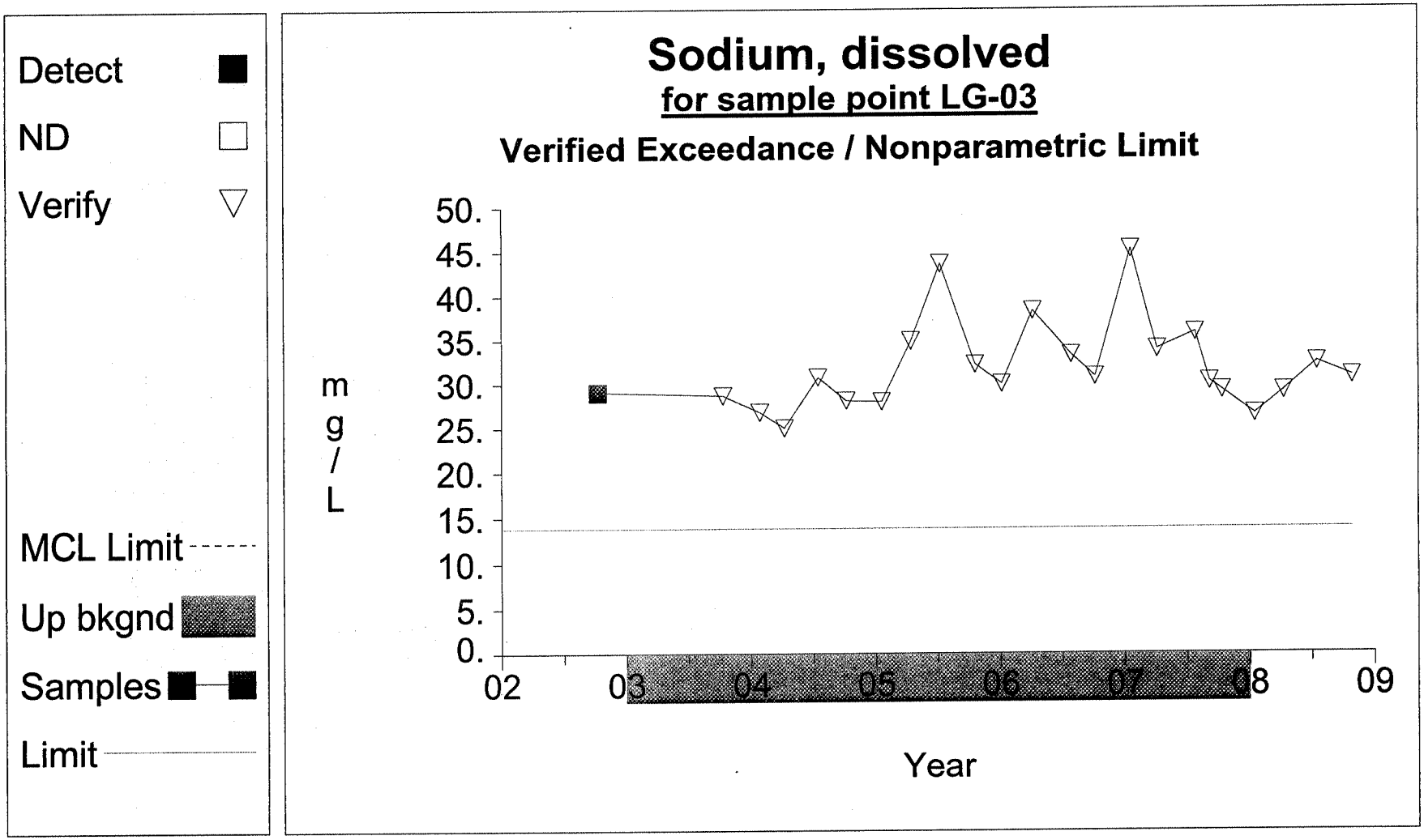
Up vs. Down Prediction Limits



Graph 106

Analysis prepared on: 1/22/2009

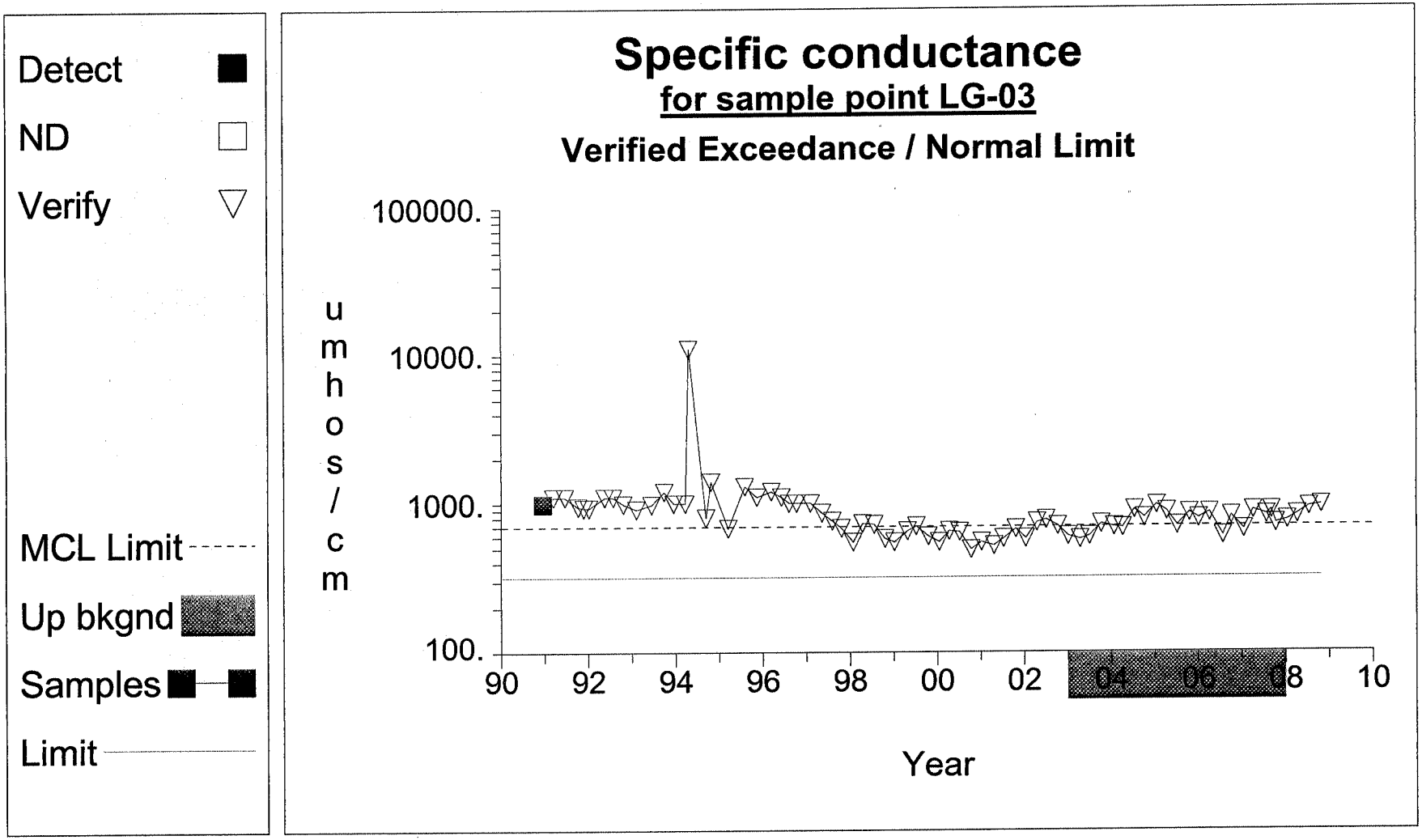
Up vs. Down Prediction Limits



Graph 110

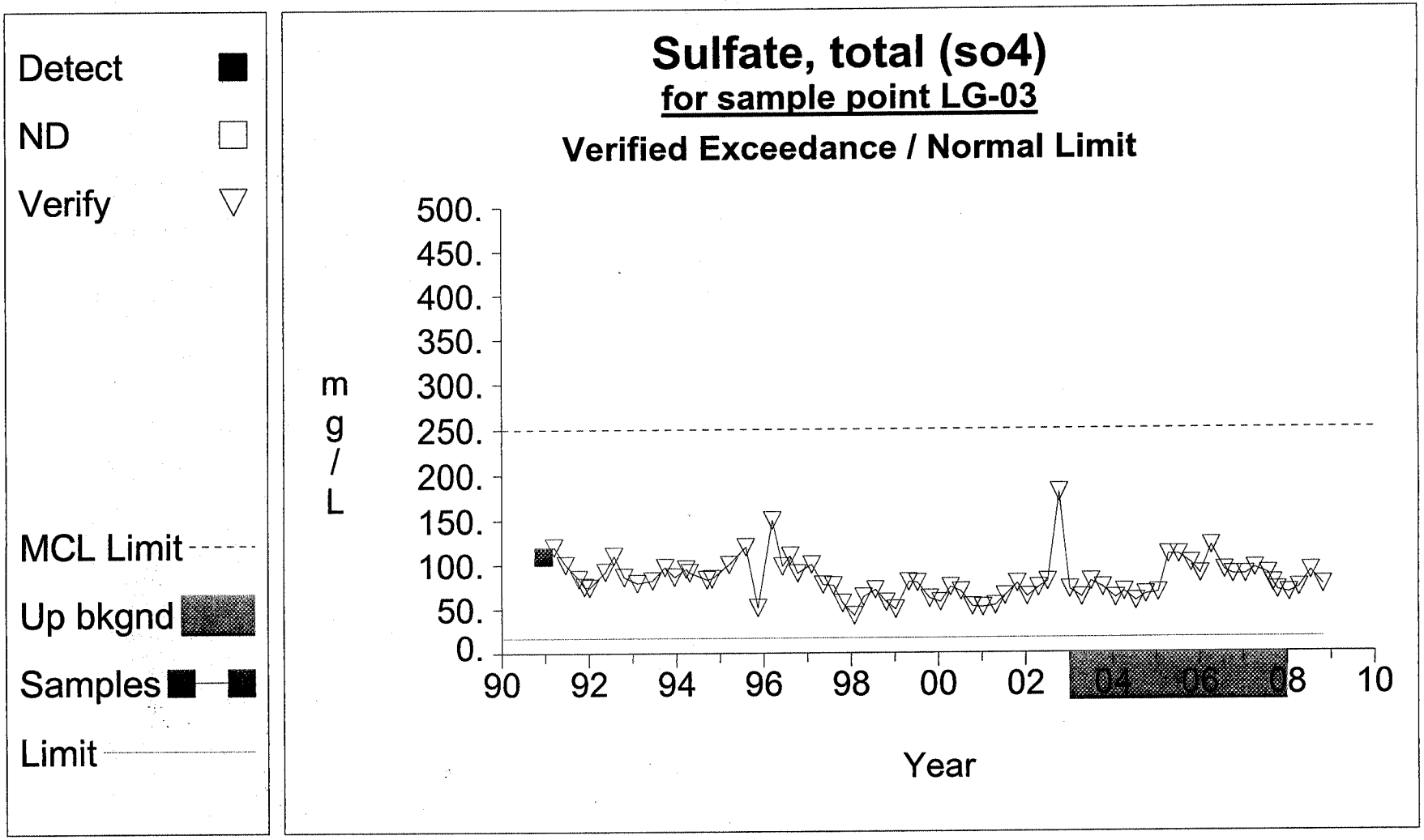
Prepared by: Snohomish County Solid Waste

Up vs. Down Prediction Limits



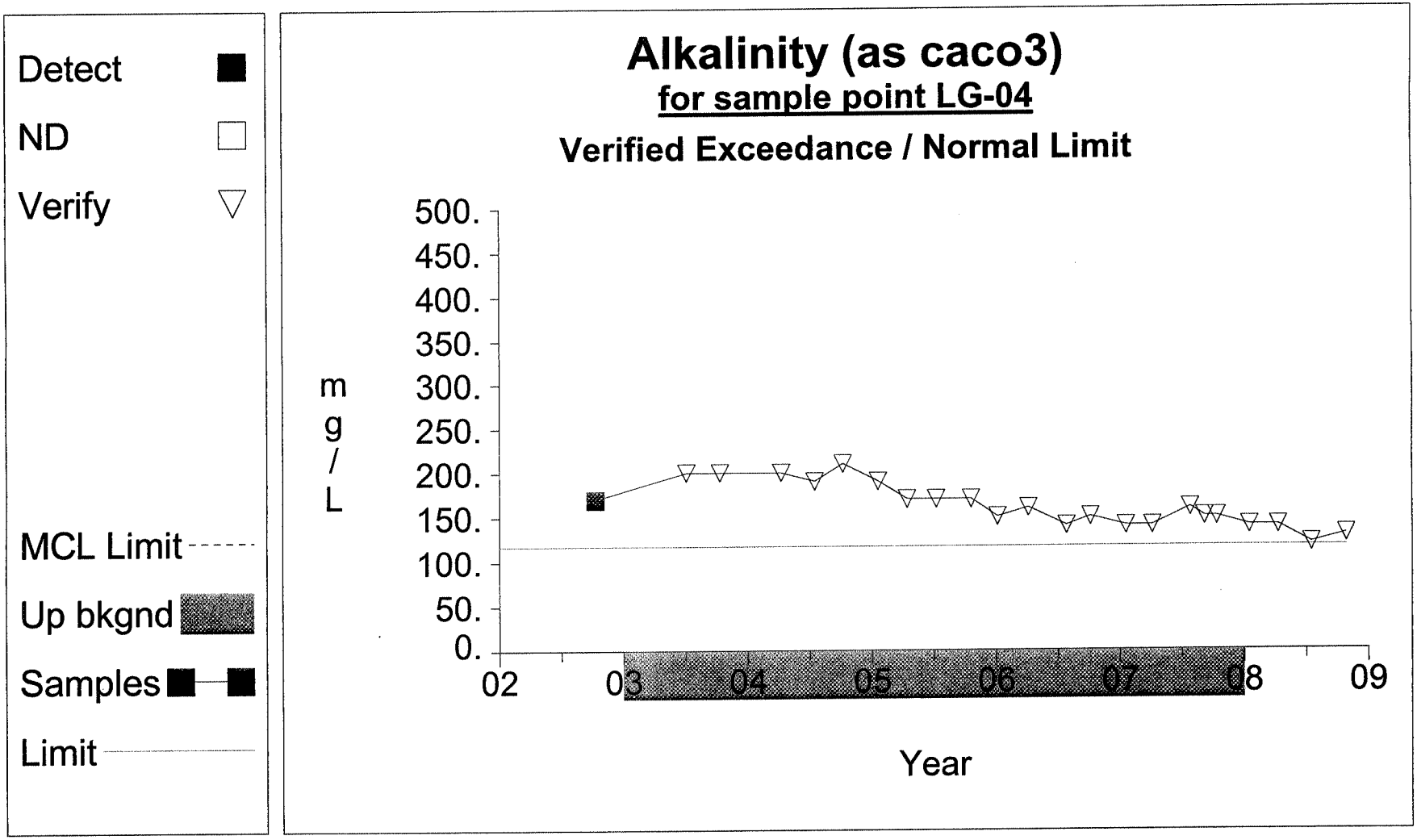
Graph 114

Up vs. Down Prediction Limits



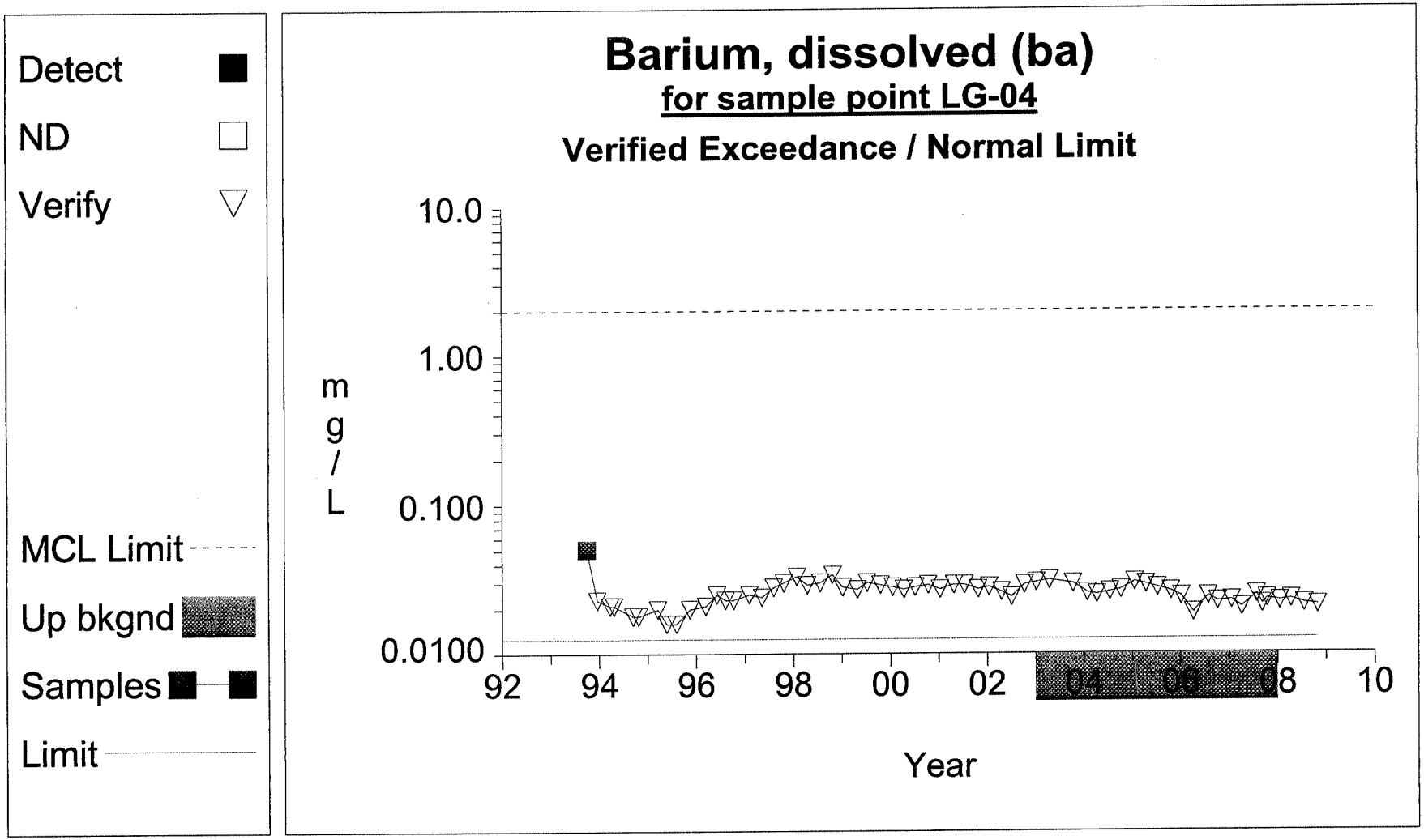
Graph 118

Up vs. Down Prediction Limits



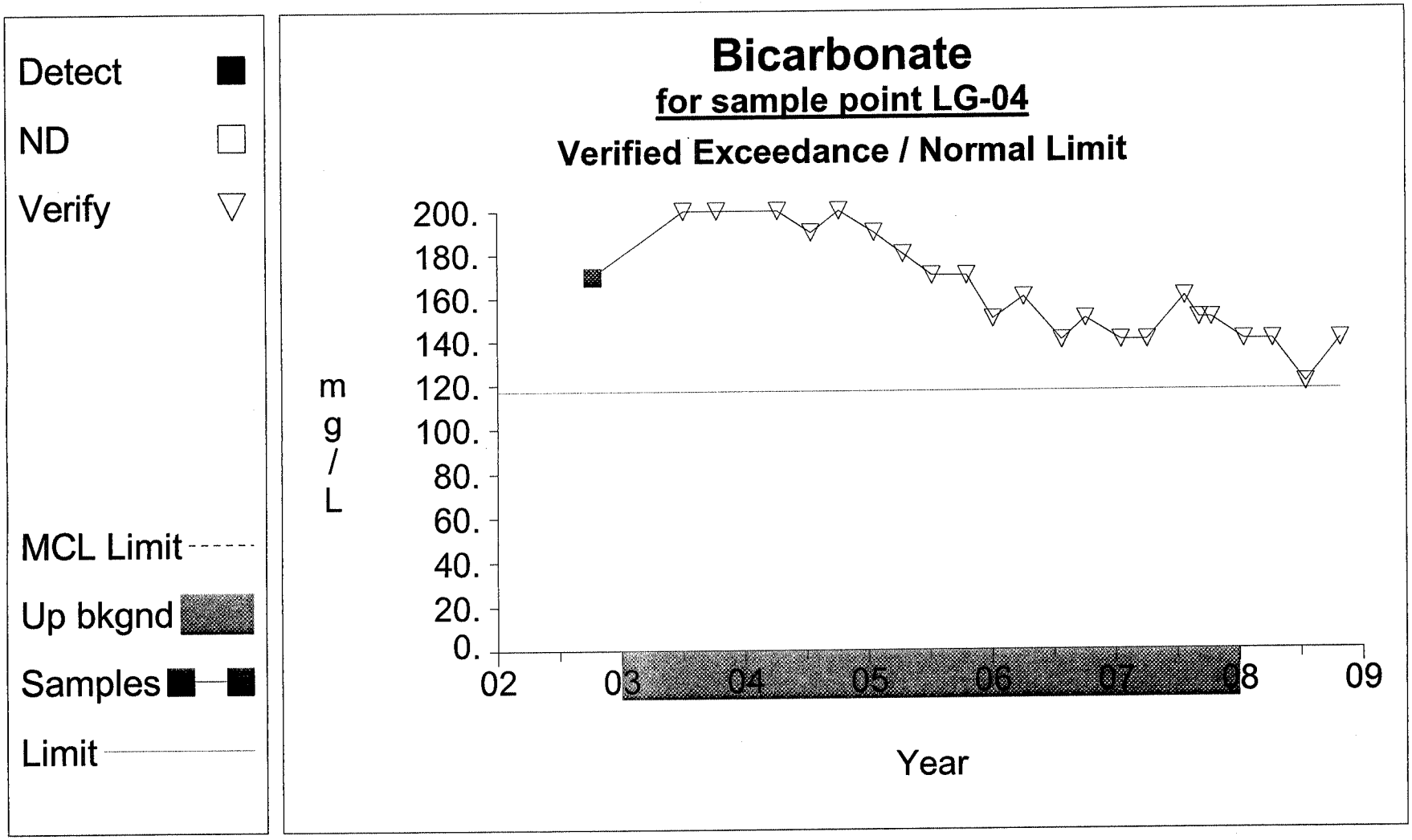
Graph 3

Up vs. Down Prediction Limits



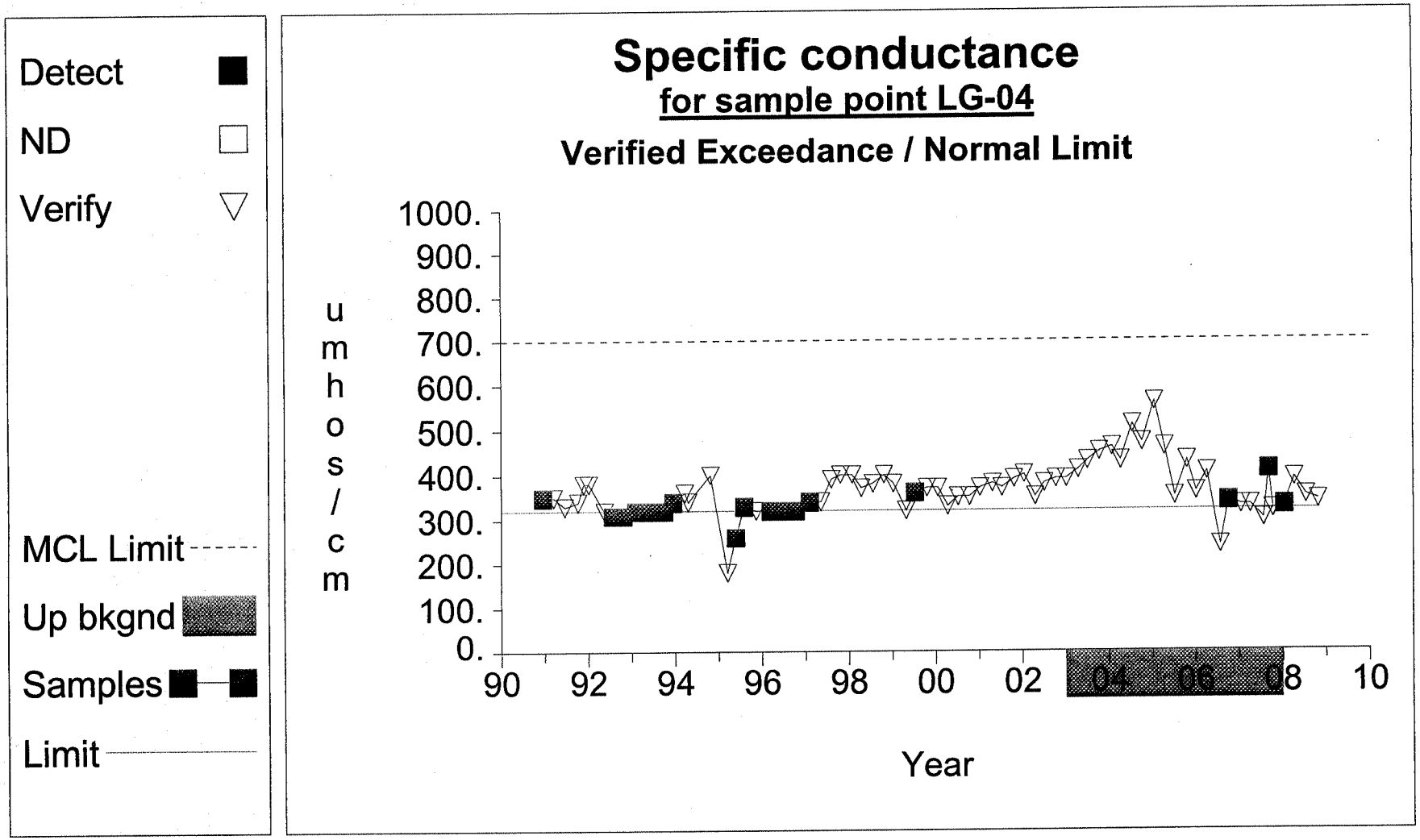
Graph 19

Up vs. Down Prediction Limits



Graph 27

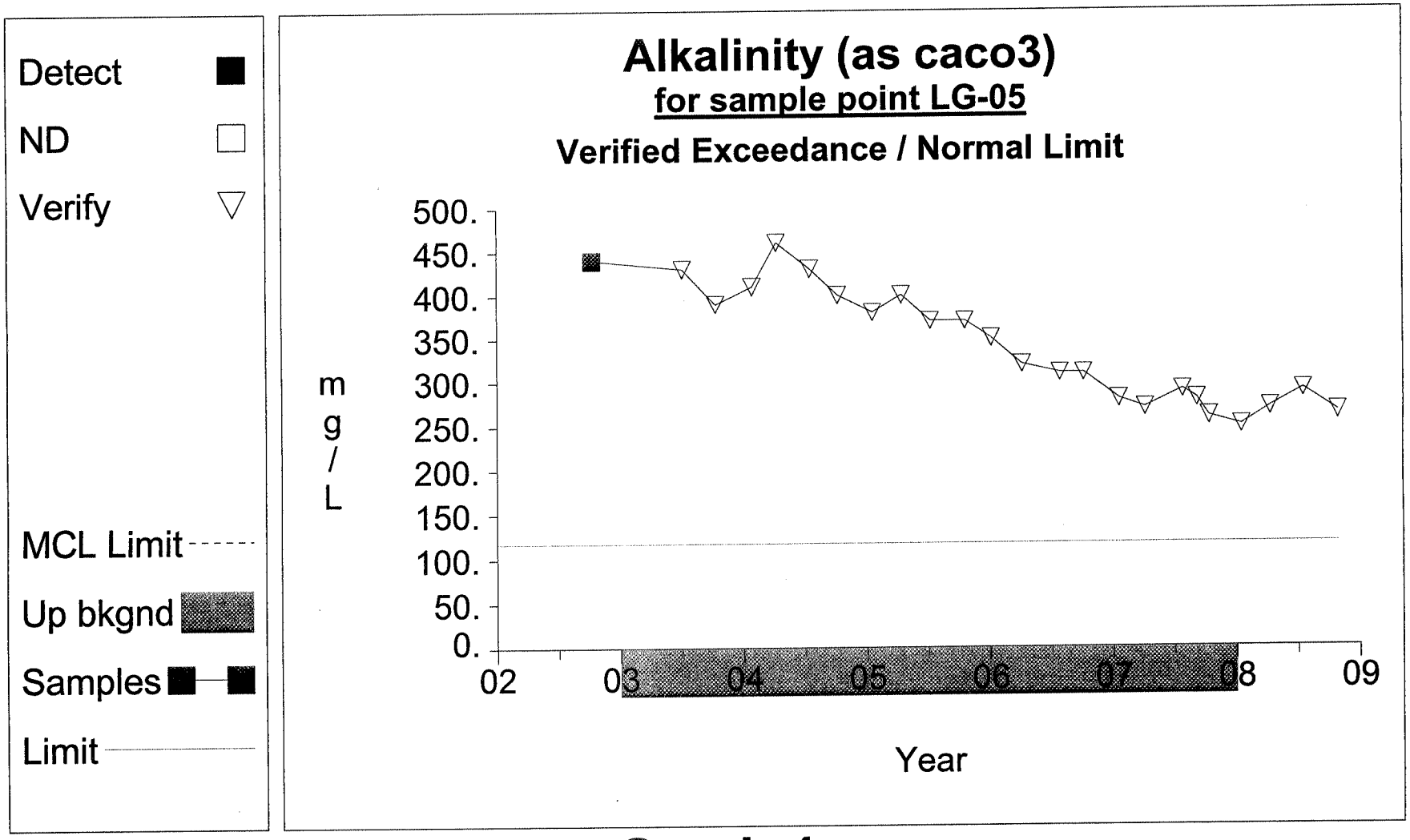
Up vs. Down Prediction Limits



Graph 115

Analysis prepared on: 1/22/2009

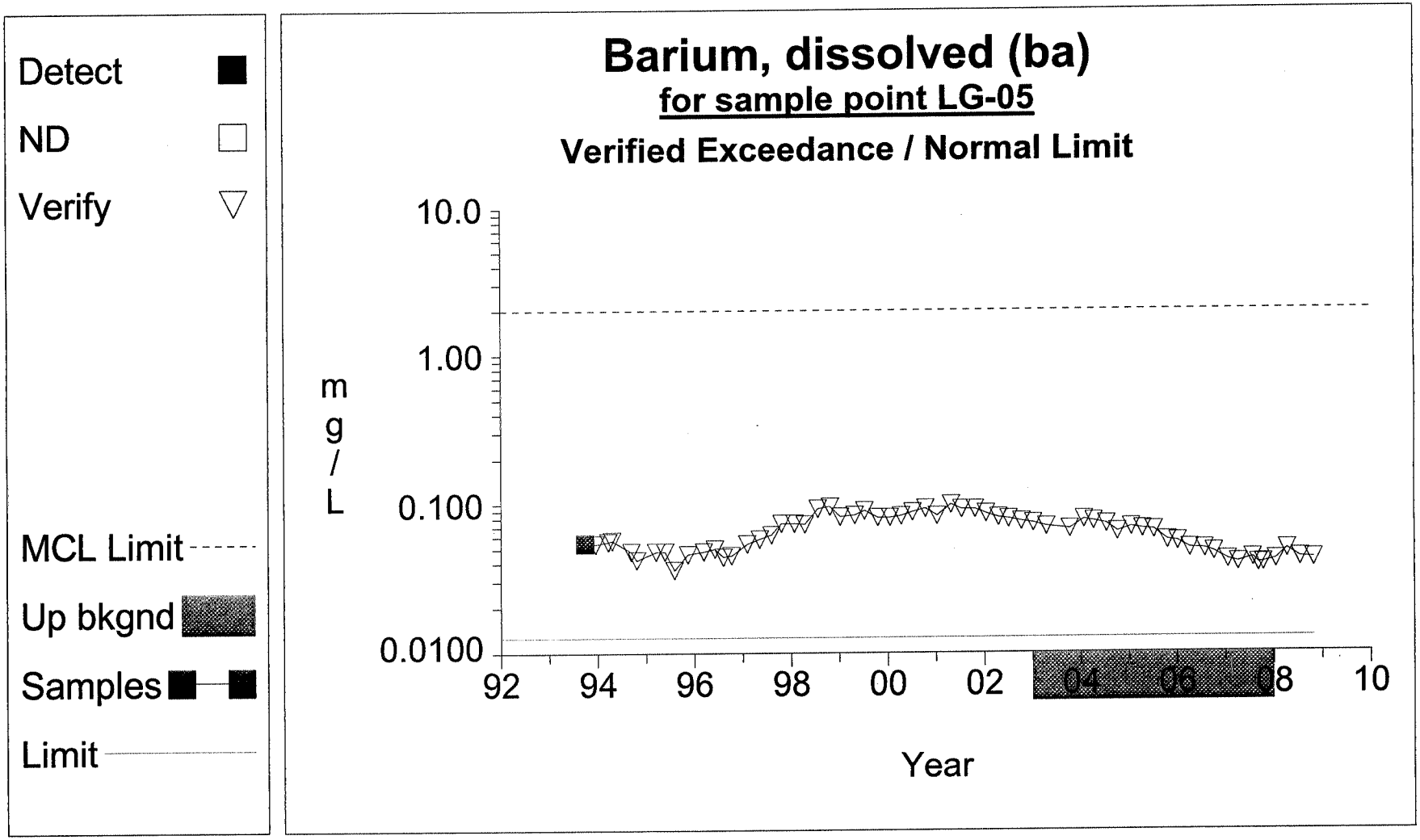
Up vs. Down Prediction Limits



Graph 4

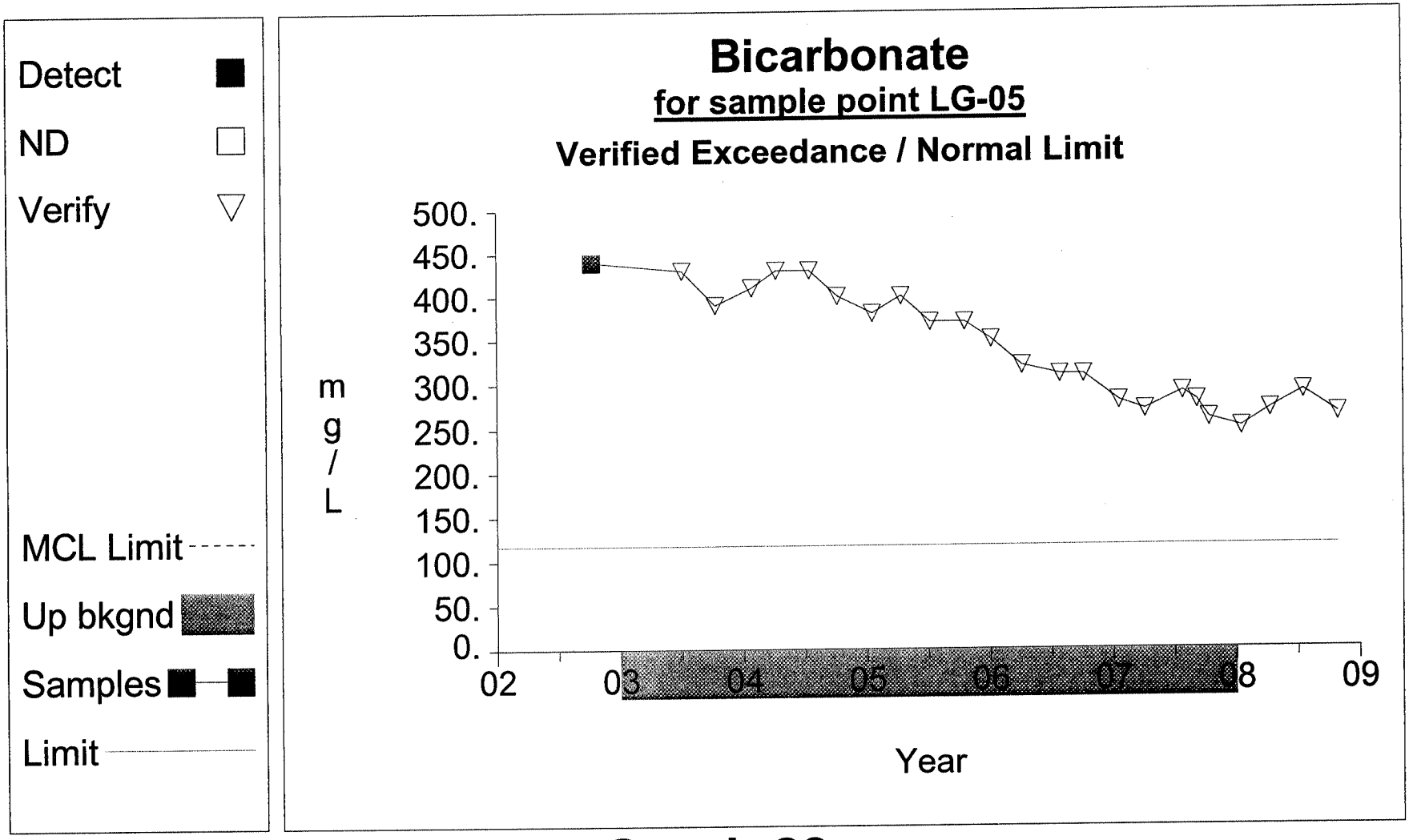
Prepared by: Snohomish County Solid Waste

Up vs. Down Prediction Limits



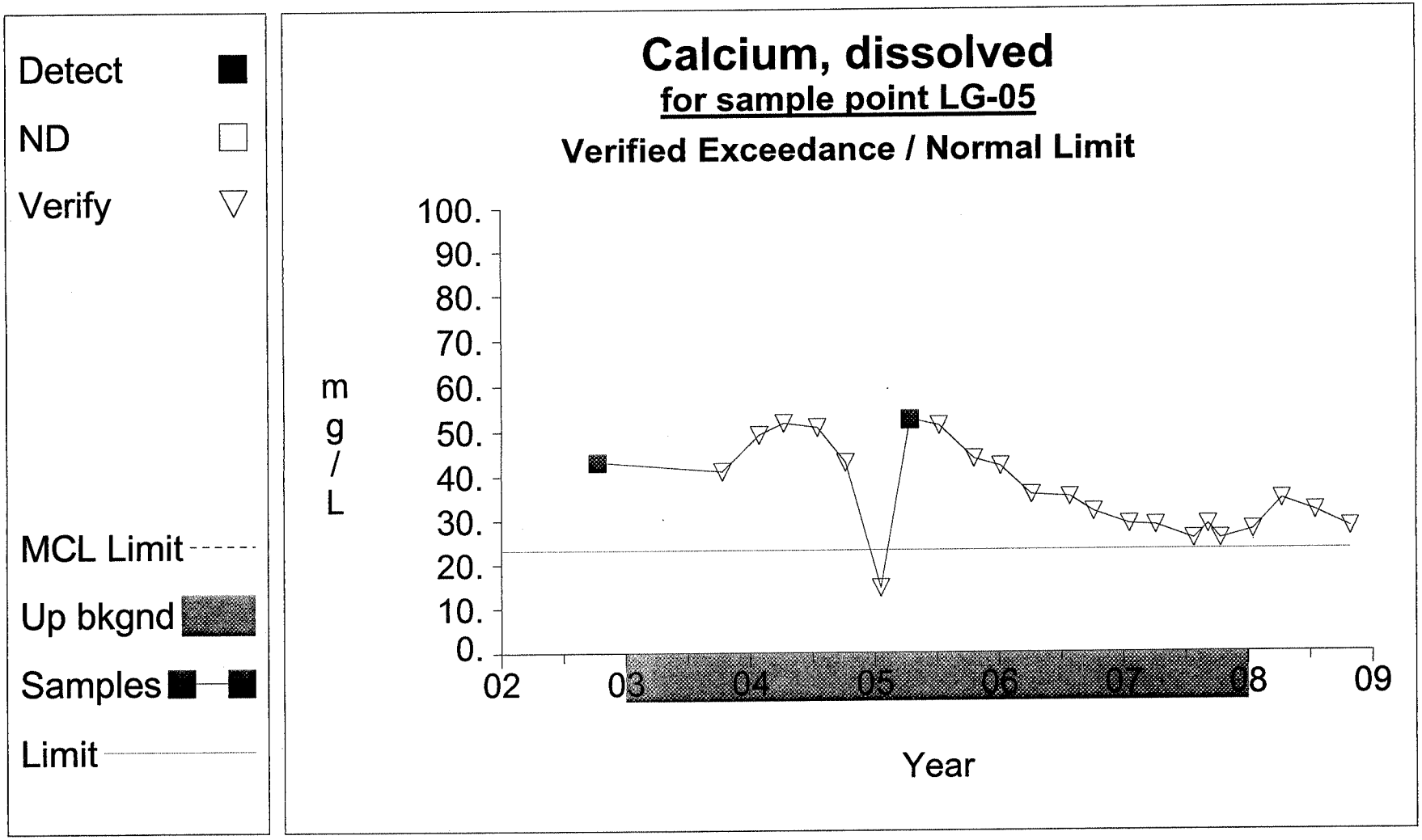
Graph 20

Up vs. Down Prediction Limits



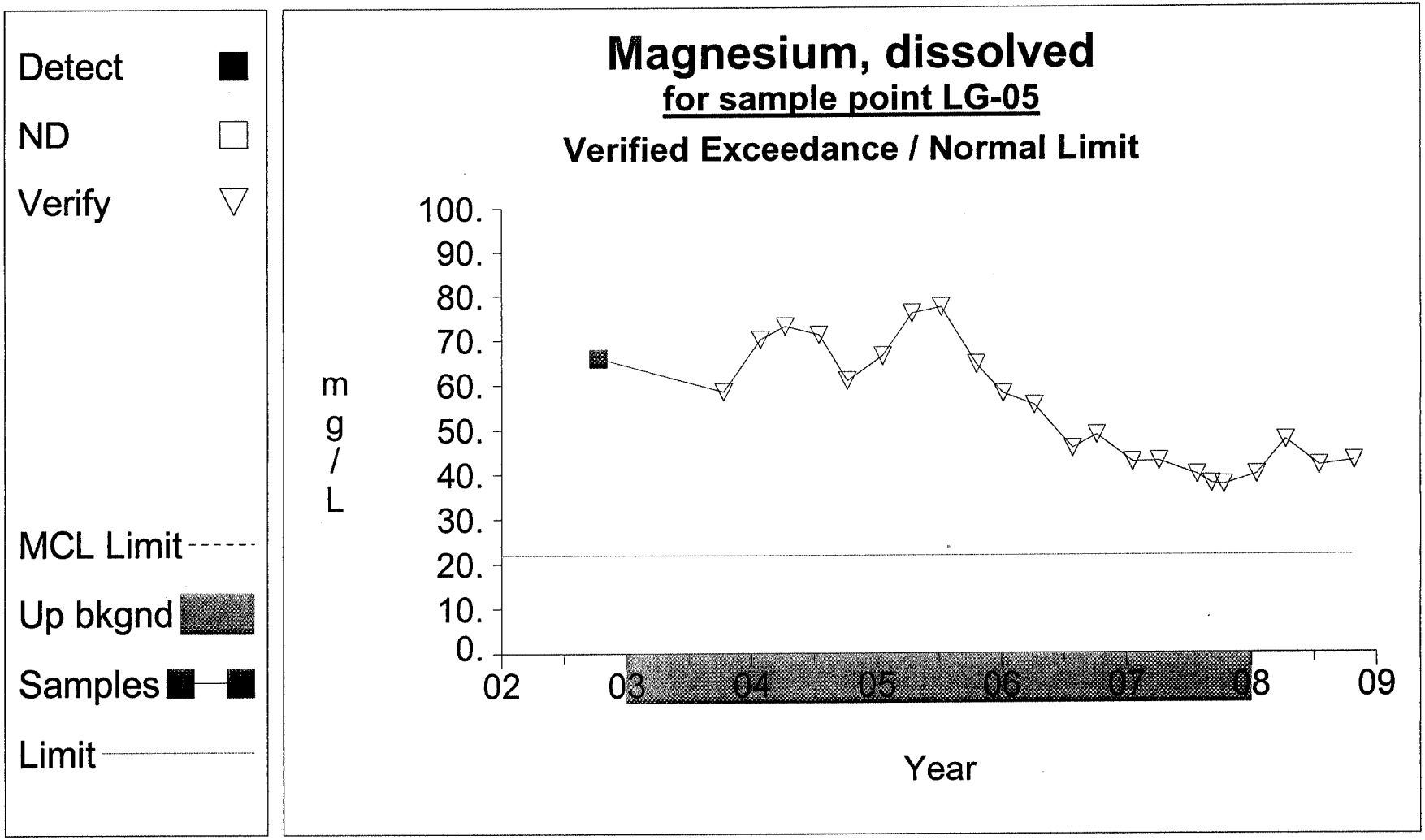
Graph 28

Up vs. Down Prediction Limits



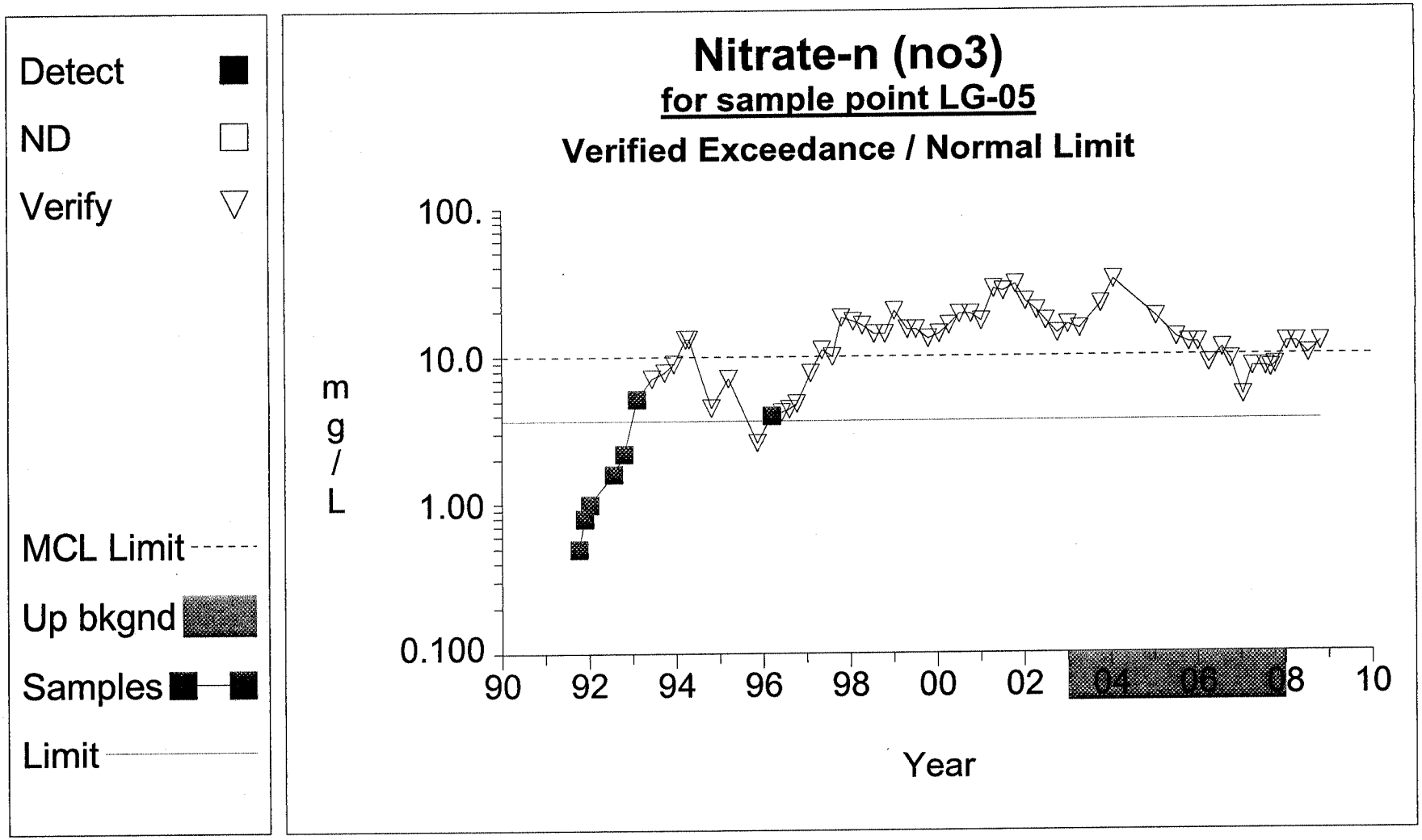
Graph 40

Up vs. Down Prediction Limits



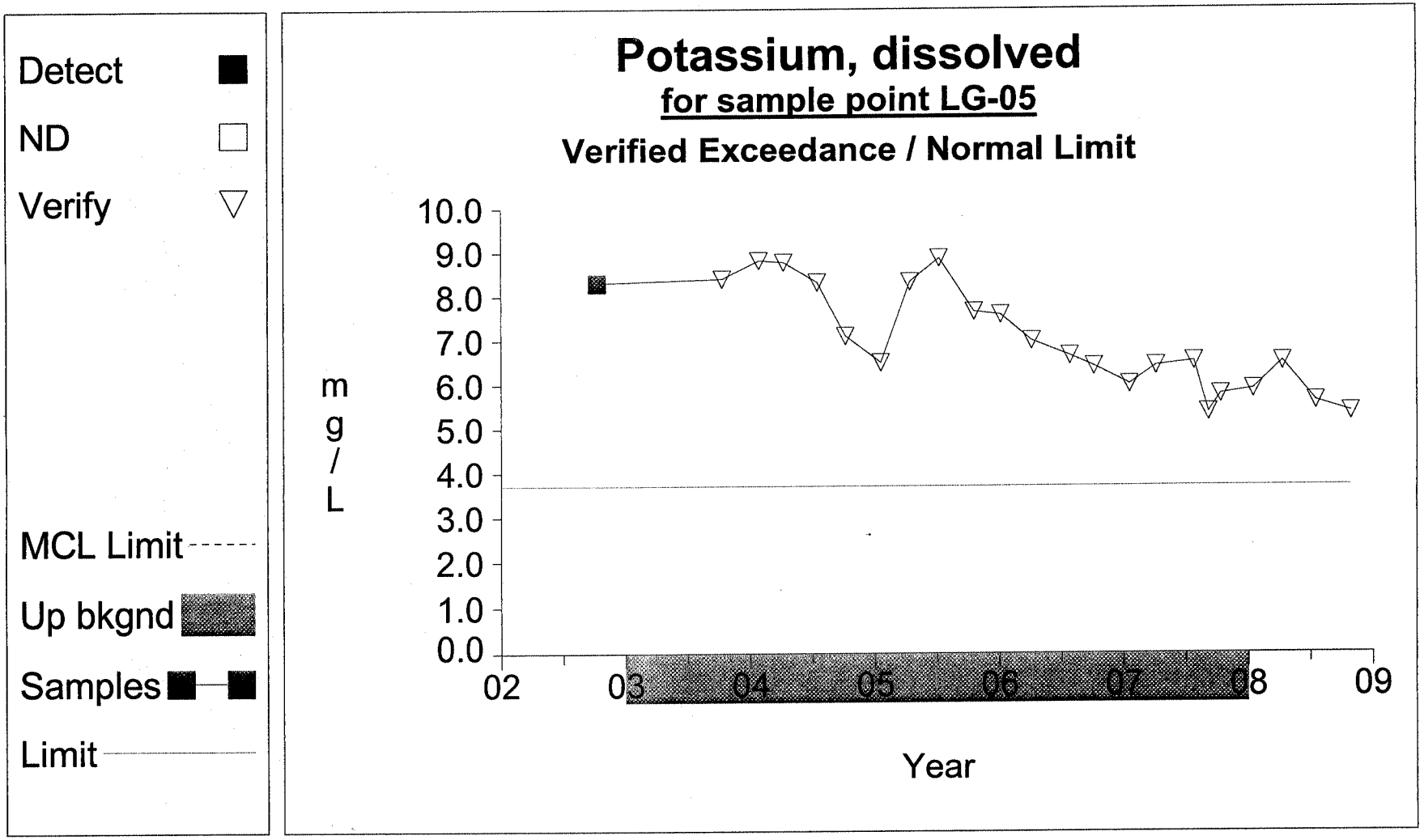
Graph 76

Up vs. Down Prediction Limits



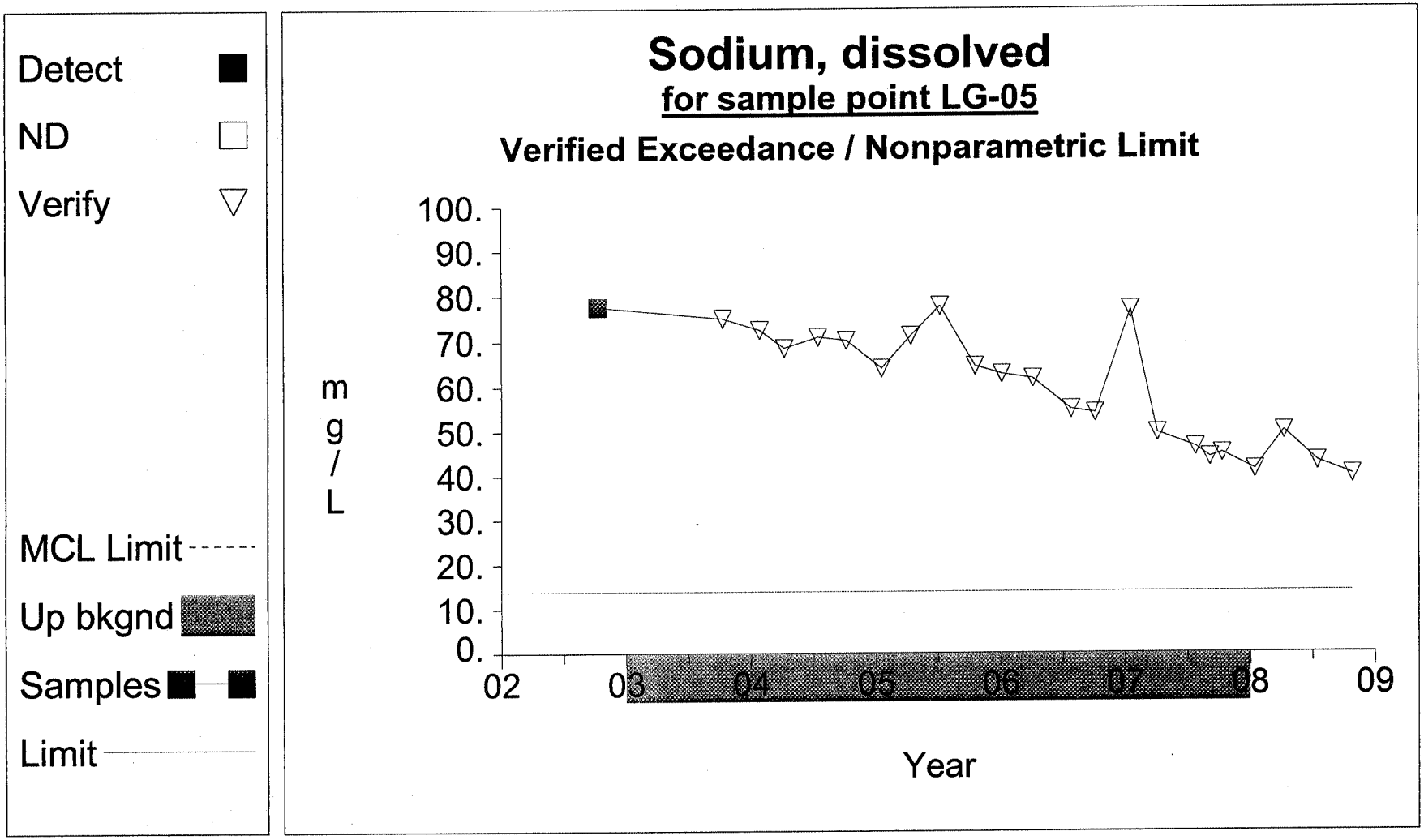
Graph 92

Up vs. Down Prediction Limits



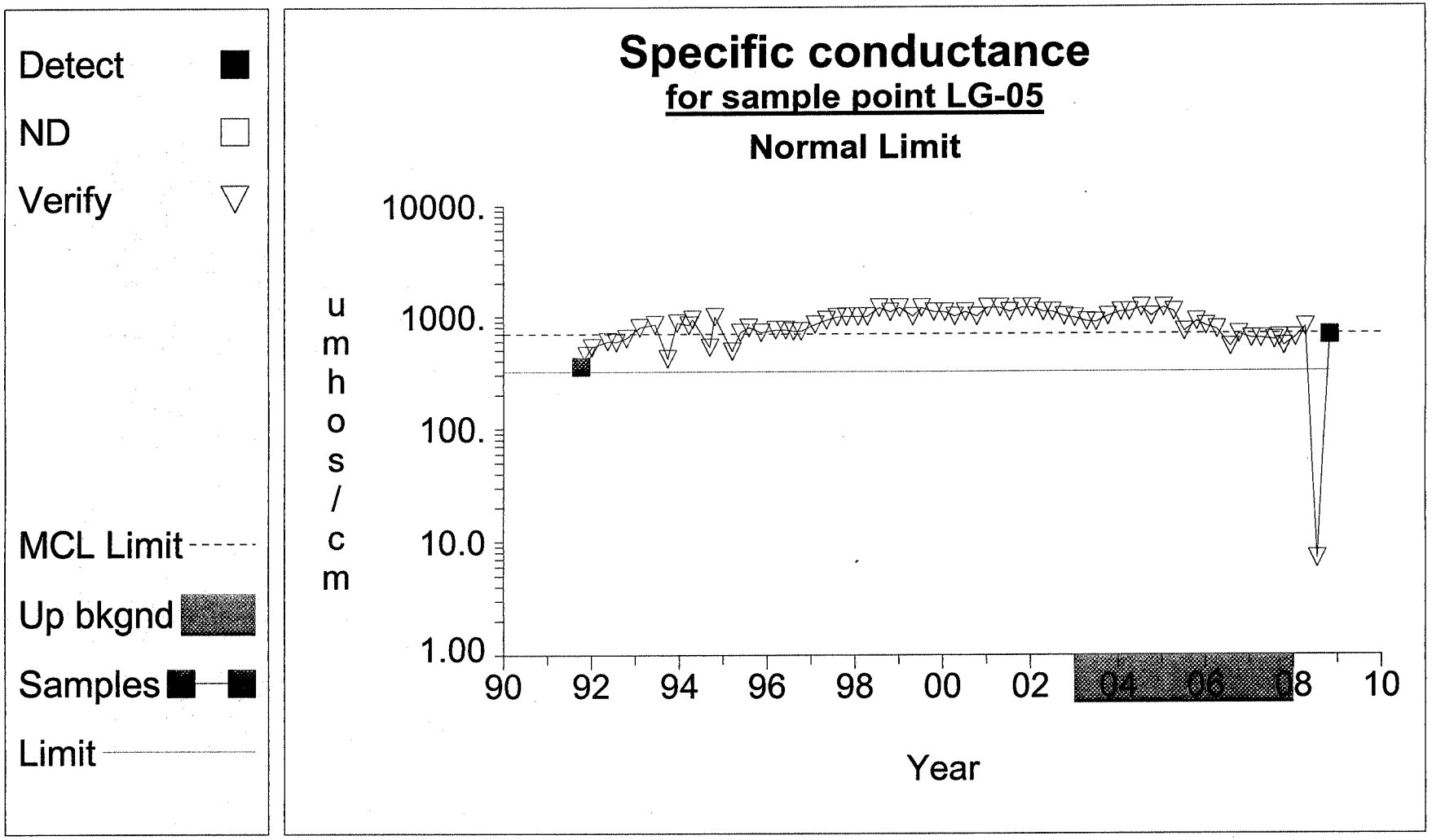
Graph 100

Up vs. Down Prediction Limits



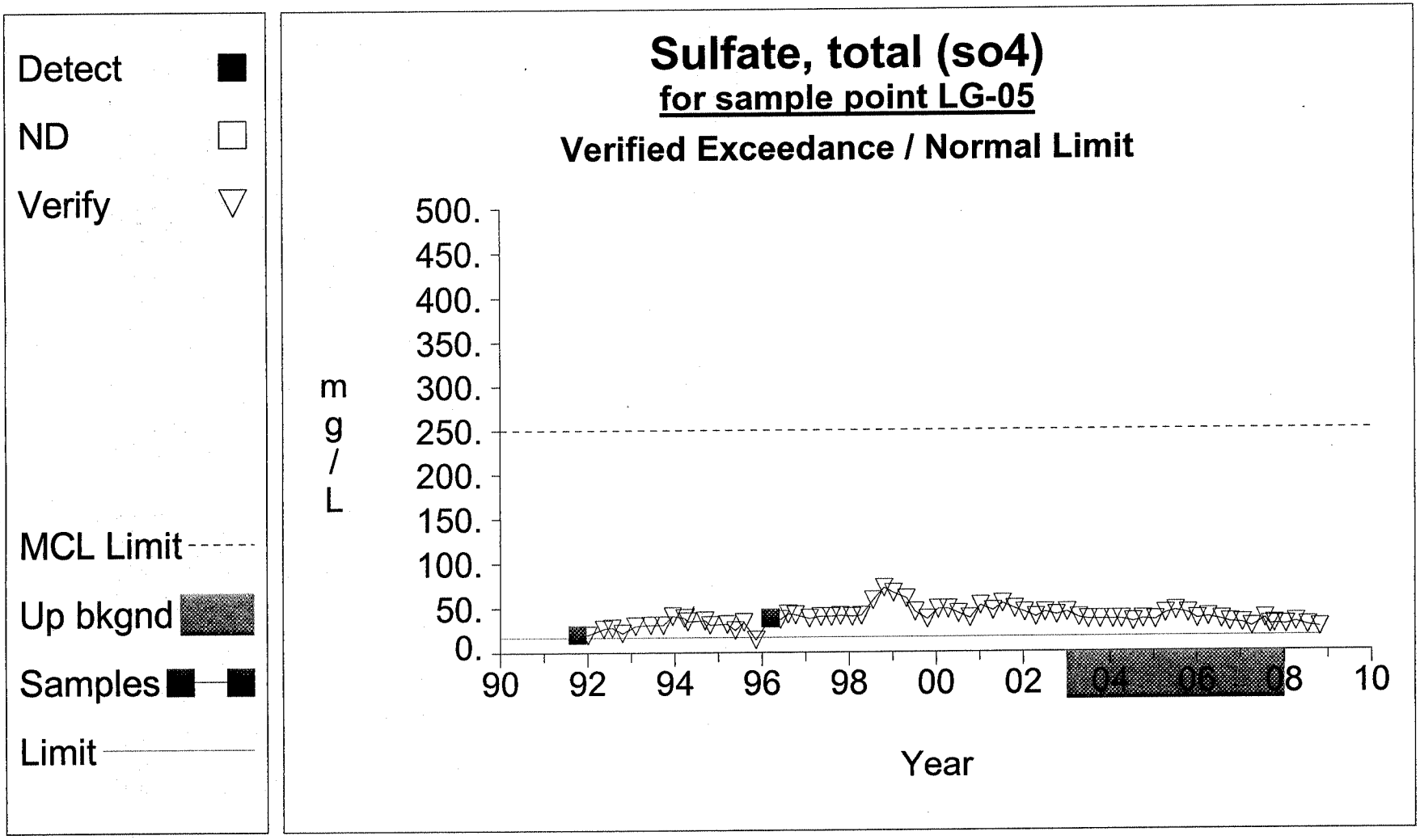
Graph 112

Up vs. Down Prediction Limits



Graph 116

Up vs. Down Prediction Limits



Graph 120

APPENDIX I

1st Quarter 2008

Constituents	LG-1		LG-3		LG-4		LG-5	
	MCL	STAT	MCL	STAT	MCL	STAT	MCL	STAT
Alkalinity		X		X		X		X
Ammonia								
Antimony								
Arsenic								
Barium		X		X		X		X
Beryllium								
Bicabonate		X		X		X		X
C-alkalinity								
Cadmium				X				
Calcium				X				X
COD								
Chloride				X				
Chromium								
Cobalt								
Coliform-T								
Copper								
Iron								
Lead								
Magnesium		X		X				X
Manganese								
Mercury								
Nickel				X				
Nitrate-N				X			X	X
pH					X		X	
Potassium		X		X				X
Selenium								
Silver								
Sodium				X		X		X
Specific Cond.		X	X	X				X
Sulfate-T		X		X				X
Thallium								
TDS								
TOC								
Vanadium								
Zinc								

2nd Quarter 2008

Consituent	LG-1		LG-3		LG-4		LG-5	
	MCL	STAT	MCL	STAT	MCL	STAT	MCL	STAT
Alkalinity		X		X		X		X
Ammonia								
Antimony								
Arsenic								
Barium		X		X		X		X
Beryllium								
Bicabonate		X		X				X
C-alkalinity								
Cadmium								
Calcium				X				X
COD								
Chloride				X				X
Chromium								
Cobalt								
Coliform-T								
Copper								
Iron								
Lead								
Magnesium		X		X				X
Manganese								
Mercury								
Nickel				X				
Nitrate-N				X			X	X
pH						X		
Potassium		X		X				X
Selenium								
Silver								
Sodium				X		X		X
Specific Cond.		X	X	X		X	X	X
Sulfate-T		X		X				X
Thallium								
TDS								
TOC								
Vanadium								
Zinc								

3rd Quarter 2008

Consituent	LG-1		LG-3		LG-4		LG-5	
	MCL	STAT	MCL	STAT	MCL	STAT	MCL	STAT
Alkalinity		X		X		X		X
Ammonia								
Antimony								
Arsenic								
Barium		X		X		X		X
Beryllium								
Bicabonate		X		X		X		X
C-alkalinity								
Cadmium								
Calcium		X		X				X
COD								
Chloride				X				X
Chromium								
Cobalt								
Coliform-T								
Copper								
Iron								
Lead								
Magnesium		X		X				X
Manganese								
Mercury								
Nickel				X				
Nitrate-N				X				X
pH			X		X	X	X	
Potassium				X				X
Selenium								
Silver								
Sodium				X		X		X
Specific Cond.		X	X	X		X		
Sulfate-T		X		X				X
Thallium								
TDS			X					
TOC								
Vanadium								
Zinc								

4th Quarter 2008

Consituent	LG-1		LG-3		LG-4		LG-5	
	MCL	STAT	MCL	STAT	MCL	STAT	MCL	STAT
Alkalinity		X		X		X		X
Ammonia								
Antimony								
Arsenic			X					
Barium		X		X		X		X
Beryllium								
Bicabonate		X		X		X		X
C-alkalinity								
Cadmium								
Calcium				X				X
COD								
Chloride				X				
Chromium								
Cobalt								
Coliform-T								
Copper								
Iron								
Lead								
Magnesium		X		X				X
Manganese								
Mercury								
Nickel				X				
Nitrate-N				X			X	X
pH								
Potassium				X				X
Selenium								
Silver								
Sodium				X				X
Specific Cond.		X	X	X		X	X	X
Sulfate-T		X		X				X
Thallium								
TDS			X					
TOC								
Vanadium								
Zinc								