

## **APPENDIX A**

### **Summary of Literature Reported Long-Term (Chronic) Aquatic Toxicity Testing Data: NaCl, KCl, CaCl<sub>2</sub> and MgCl<sub>2</sub> Salts**

Table A-1. LONG-TERM/ CHRONIC DATA - NaCl, KCl, CaCl<sub>2</sub>, and MgCl<sub>2</sub> SALTS

| Class          | Species                      | Common name    | Endpoint          | Endpoint criteria              | Exp. time (h) | LT (SSD) <sup>A</sup> | Data quality <sup>B</sup>                              | Exp. type <sup>C</sup> | Chloride (mg Cl/L) | Hardness <sup>D</sup> (mg CaCO <sub>3</sub> /L) | Alkalinity (mg CaCO <sub>3</sub> /L) | Dissolved oxygen (mg O <sub>2</sub> /L) | pH      | Temp. (°C) | Life stage characteristics      | Citation                       |
|----------------|------------------------------|----------------|-------------------|--------------------------------|---------------|-----------------------|--------------------------------------------------------|------------------------|--------------------|-------------------------------------------------|--------------------------------------|-----------------------------------------|---------|------------|---------------------------------|--------------------------------|
| NaCl           |                              |                |                   |                                |               |                       |                                                        |                        |                    |                                                 |                                      |                                         |         |            |                                 |                                |
| Actinopterygii | <i>Carassius auratus</i>     | Goldfish       | Survival          | Mortality                      | 96-240        | Chronic               | ? U (No statistical significant comparison to control) | ?                      | 6066               | N/S                                             | N/S                                  | >6                                      | 6.7     | 18-23      | N/S                             | Ellis (1937)                   |
| Actinopterygii | <i>Carassius auratus</i>     | Goldfish       | Survival          | Mortality                      | >600          | LT                    | ? U (No statistical significant comparison to control) | ?                      | 3033               | N/S                                             | N/S                                  | >6                                      | 6.7     | 18-23      | N/S                             | Ellis (1937)                   |
| Actinopterygii | <i>Carassius auratus</i>     | Goldfish       | Survival          | Mortality                      | 17-154        | Chronic               | ? U (Dilution water quality questionable)              | ?                      | 7097               | N/S                                             | N/S                                  | N/S                                     | N/S     | 21         | N/S                             | Powers (1917)                  |
| Actinopterygii | <i>Carassius auratus</i>     | Goldfish       | LC <sub>50</sub>  | Mortality                      | 240           | Chronic               | P/S                                                    | S                      | 2623               | 149                                             | 100                                  | >75 % sat                               | 7.95    | 23.5       | Adult (0.38-4.02 g body weight) | Threader & Houston (1983)      |
| Actinopterygii | <i>Morone sp.</i>            | Bass           | LC <sub>0</sub>   | Mortality                      | 336           | Chronic               | U                                                      | N/S                    | 8492               | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                             | Black (1950)                   |
| Actinopterygii | <i>Notropis atherinoides</i> | Emerald Shiner | LOEC              | Mortality                      | 120           | Chronic               | ? U (No statistical significant comparison to control) | ?                      | 1517               | N/S                                             | N/S                                  | >4                                      | N/S     | 18         | N/S                             | van Hom <i>et al.</i> (1949)   |
| Actinopterygii | <i>Notropis bienniis</i>     | River shiner   | LC <sub>100</sub> | Mortality (time to 100% mort.) | 216-576       | Chronic               | U (control survival of 68%)                            | SR                     | 1524               | N/S                                             | N/S                                  | N/S                                     | N/S     | 20         | Juvenile (minnow)               | Garrey (1916)                  |
| Actinopterygii | <i>Oncorhynchus mykiss</i>   | Rainbow trout  | EC <sub>25</sub>  | Embryo viability               | 168           | LT                    | P/S                                                    | SR                     | 989                | 120                                             | 100                                  | >9                                      | 7.3-8.5 | 14         | Embryo/Larva                    | Beak International Inc. (1999) |
| Actinopterygii | <i>Oncorhynchus mykiss</i>   | Rainbow trout  | EC <sub>50</sub>  | Embryo viability               | 168           | LT                    | P/S                                                    | SR                     | 1456               | 120                                             | 100                                  | >9                                      | 7.3-8.5 | 14         | Embryo/Larva                    | Beak International Inc. (1999) |
| Actinopterygii | <i>Oncorhynchus mykiss</i>   | Rainbow trout  | EC <sub>25</sub>  | Embryo viability               | 648           | LT                    | P/S                                                    | SR                     | 1110               | 120                                             | 100                                  | >9                                      | 7.3-8.5 | 14         | Embryo/alevin                   | Beak International Inc. (1999) |
| Actinopterygii | <i>Oncorhynchus mykiss</i>   | Rainbow trout  | EC <sub>50</sub>  | Embryo viability               | 648           | LT                    | P/S                                                    | SR                     | 1595               | 120                                             | 100                                  | >9                                      | 7.3-8.5 | 14         | Embryo/alevin                   | Beak International Inc. (1999) |
| Actinopterygii | <i>Oncorhynchus mykiss</i>   | Rainbow trout  | NOEC              | Mortality                      | 192           | LT                    | P/S                                                    | S                      | 485                | 23                                              | 32                                   | 10                                      | 7.63    | 15-16      | Fingerling (1440 h old)         | Camargo & Tarazona (1991)      |
| Actinopterygii | <i>Oncorhynchus mykiss</i>   | Rainbow trout  | IC <sub>25</sub>  | Biomass                        | 1296          | LT                    | P/S                                                    | SR                     | 1174               | 42                                              | 36-60                                | N/S                                     | 7.2-7.6 | 14         | 0.5 h post fertilization        | Elphick <i>et al.</i> (2011a)  |
| Actinopterygii | <i>Oncorhynchus mykiss</i>   | Rainbow trout  | IC <sub>50</sub>  | Biomass                        | 1296          | LT                    | P/S                                                    | SR                     | 1559               | 42                                              | 36-60                                | N/S                                     | 7.2-7.6 | 14         | 0.5 h post fertilization        | Elphick <i>et al.</i> (2011a)  |
| Actinopterygii | <i>Oncorhynchus mykiss</i>   | Rainbow trout  | NOEC              | Biomass                        | 1296          | LT                    | P/S                                                    | SR                     | 1104               | 42                                              | 36-60                                | N/S                                     | 7.2-7.6 | 14         | 0.5 h post fertilization        | Elphick <i>et al.</i> (2011a)  |
| Actinopterygii | <i>Oncorhynchus mykiss</i>   | Rainbow trout  | LOEC              | Biomass                        | 1296          | LT                    | P/S                                                    | SR                     | 2327               | 42                                              | 36-60                                | N/S                                     | 7.2-7.6 | 14         | 0.5 h post fertilization        | Elphick <i>et al.</i> (2011a)  |
| Actinopterygii | <i>Oncorhynchus mykiss</i>   | Rainbow trout  | NOEC              | Mortality                      | 1296          | LT                    | P/S                                                    | SR                     | 1104               | 58 (40-76)                                      | 36-60                                | 6.6-10.6                                | 7.1-7.8 | 13-15      | Fertilized gamelets             | Rescan (2007)                  |
| Actinopterygii | <i>Oncorhynchus mykiss</i>   | Rainbow trout  | LOEC              | Mortality                      | 1296          | LT                    | P/S                                                    | SR                     | 2327               | 58 (40-76)                                      | 36-60                                | 6.6-10.6                                | 7.1-7.8 | 13-15      | Fertilized gamelets             | Rescan (2007)                  |
| Actinopterygii | <i>Oncorhynchus mykiss</i>   | Rainbow trout  | MATC              | Mortality                      | 1296          | LT                    | P/S                                                    | SR                     | 1603               | 58 (40-76)                                      | 36-60                                | 6.6-10.6                                | 7.1-7.8 | 13-15      | Fertilized gamelets             | Rescan (2007)                  |
| Actinopterygii | <i>Oncorhynchus mykiss</i>   | Rainbow trout  | NOEC              | Mortality                      | 1296          | LT                    | P/S                                                    | SR                     | 1104               | 58 (40-76)                                      | 36-60                                | 6.6-10.6                                | 7.1-7.8 | 13-15      | Fertilized gamelets             | Rescan (2007)                  |
| Actinopterygii | <i>Oncorhynchus mykiss</i>   | Rainbow trout  | MATC              | Mortality                      | 1296          | LT                    | P/S                                                    | SR                     | 1603               | 58 (40-76)                                      | 36-60                                | 6.6-10.6                                | 7.1-7.8 | 13-15      | Fertilized gamelets             | Rescan (2007)                  |

Table A-1. LONG-TERM/ CHRONIC DATA - NaCl, KCl, CaCl<sub>2</sub>, and MgCl<sub>2</sub> SALTS

| Class          | Species                    | Common name    | Endpoint           | Endpoint criteria                   | Exp. time (h) | LT (SSD) <sup>A</sup> | Data quality <sup>B</sup> | Exp. type <sup>C</sup> | Chloride (mg Cl/L) | Hardness <sup>D</sup> (mg CaCO <sub>3</sub> /L) | Alkalinity (mg CaCO <sub>3</sub> /L) | Dissolved oxygen (mg O <sub>2</sub> /L) | pH      | Temp. (°C) | Life stage characteristics                    | Citation                       |
|----------------|----------------------------|----------------|--------------------|-------------------------------------|---------------|-----------------------|---------------------------|------------------------|--------------------|-------------------------------------------------|--------------------------------------|-----------------------------------------|---------|------------|-----------------------------------------------|--------------------------------|
| Actinopterygii | <i>Oncorhynchus mykiss</i> | Rainbow trout  | LC <sub>50</sub>   | Mortality                           | 1296          | Chronic               | P/S                       | SR                     | 1511               | 58 (40-76)                                      | 36-60                                | 6.6-10.6                                | 7.1-7.8 | 13-15      | Fertilized gametes                            | Rescan (2007)                  |
| Actinopterygii | <i>Perca flavescens</i>    | Yellow perch   | LC <sub>0</sub>    | Mortality                           | 336           | Chronic               | U                         | N/S                    | 8492               | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                                           | Black (1950)                   |
| Actinopterygii | <i>Perca flavescens</i>    | Yellow perch   | See footnotes E(I) | Survival (gradual increase in NaCl) | 720           | Chronic               | ?                         | ?                      | 5520-10616         | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                                           | Young (1923)                   |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | NOEC               | Mortality                           | 168           | LT                    | P/S                       | SR                     | 1213               | 115                                             | 70-80                                | >5.8                                    | 7.5-8.3 | 25         | Larva (<24 h old)                             | Beak International Inc. (1999) |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | LOEC               | Mortality                           | 168           | LT                    | P/S                       | SR                     | 2426               | 115                                             | 70-80                                | >5.8                                    | 7.5-8.3 | 25         | Larva (<24 h old)                             | Beak International Inc. (1999) |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | MATC               | Mortality                           | 168           | LT                    | P/S                       | SR                     | 1715               | 115                                             | 70-80                                | >5.8                                    | 7.5-8.3 | 25         | Larva (<24 h old)                             | Beak International Inc. (1999) |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | IC <sub>25</sub>   | Growth                              | 168           | LT                    | P/S                       | SR                     | 1741               | 115                                             | 70-80                                | >5.8                                    | 7.5-8.3 | 25         | Larva (<24 h old)                             | Beak International Inc. (1999) |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | IC <sub>50</sub>   | Growth                              | 168           | LT                    | P/S                       | SR                     | 3027               | 115                                             | 70-80                                | >5.8                                    | 7.5-8.3 | 25         | Larva (<24 h old)                             | Beak International Inc. (1999) |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | LC <sub>50</sub>   | Mortality                           | 168           | Chronic               | P/S                       | SR                     | 3320               | 115                                             | 70-80                                | >5.8                                    | 7.5-8.3 | 25         | Larva (<24 h old)                             | Beak International Inc. (1999) |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | NOEC               | Mortality                           | 168           | LT                    | P/S                       | SR                     | 607                | 120                                             | 80-100                               | >7.8                                    | 8.1-8.3 | 25         | Larva (< 36 h old larva)                      | Beak International Inc. (1999) |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | LOEC               | Mortality                           | 168           | LT                    | P/S                       | SR                     | 1213               | 120                                             | 80-100                               | >7.8                                    | 8.1-8.3 | 25         | Larva (< 36 h old larva)                      | Beak International Inc. (1999) |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | MATC               | Mortality                           | 168           | LT                    | P/S                       | SR                     | 855                | 120                                             | 80-100                               | >7.8                                    | 8.1-8.3 | 25         | Larva (< 36 h old larva)                      | Beak International Inc. (1999) |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | NOEC               | Growth, Mortality, Teratogenesis    | 792           | LT                    | P/S                       | F                      | 252                | 97                                              | 48-69                                | 7.6                                     | 7.5     | 25         | 9 h from fertilization to Juvenile life stage | Birge <i>et al.</i> (1985)     |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | NOEC               | Growth, Mortality, Teratogenesis    | 792           | LT                    | P/S                       | F                      | 352                | 97                                              | 58-66                                | 7.6                                     | 7.5     | 25         | 9 h from fertilization to Juvenile life stage | Birge <i>et al.</i> (1985)     |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | LOEC               | Survival                            | 792           | LT                    | P/S                       | F                      | 528                | 97                                              | 58-66                                | 7.6                                     | 7.5     | 25         | 9 h from fertilization to Juvenile life stage | Birge <i>et al.</i> (1985)     |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | MATC               | Survival                            | 792           | LT                    | P/S                       | F                      | 431                | 97                                              | 58-66                                | 7.6                                     | 7.5     | 25         | 9 h from fertilization to Juvenile life stage | Birge <i>et al.</i> (1985)     |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | NOEC               | Survival                            | 792           | LT                    | P/S                       | F                      | 498                | 97                                              | 58-66                                | 7.6                                     | 7.5     | 25         | 9 h from fertilization to Juvenile life stage | Birge <i>et al.</i> (1985)     |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | LOEC               | Survival                            | 792           | LT                    | P/S                       | F                      | 693                | 97                                              | 58-66                                | 7.6                                     | 7.5     | 25         | 9 h from fertilization to Juvenile life stage | Birge <i>et al.</i> (1985)     |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | MATC               | Survival                            | 792           | LT                    | P/S                       | F                      | 587                | 97                                              | 58-66                                | 7.6                                     | 7.5     | 25         | 9 h from fertilization to Juvenile life stage | Birge <i>et al.</i> (1985)     |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | NOEC               | Growth                              | 792           | LT                    | P/S                       | F                      | 533                | 97                                              | 58-66                                | 7.6                                     | 7.5     | 25         | 9 h from fertilization to Juvenile life stage | Birge <i>et al.</i> (1985)     |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | LOEC               | Growth                              | 792           | LT                    | P/S                       | F                      | 734                | 97                                              | 58-66                                | 7.6                                     | 7.5     | 25         | 9 h from fertilization to Juvenile life stage | Birge <i>et al.</i> (1985)     |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | MATC               | Growth                              | 792           | LT                    | P/S                       | F                      | 625                | 97                                              | 58-66                                | 7.6                                     | 7.5     | 25         | 9 h from fertilization to Juvenile life stage | Birge <i>et al.</i> (1985)     |

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| Class          | Species                    | Common name    | Endpoint         | Endpoint criteria | Exp. time (h) | LT (SSD) <sup>A</sup> | Data quality <sup>B</sup> | Exp. type <sup>C</sup> | Chloride (mg Cl/L) | Hardness <sup>D</sup> (mg CaCO <sub>3</sub> /L) | Alkalinity (mg CaCO <sub>3</sub> /L) | Dissolved oxygen (mg O <sub>2</sub> /L) | pH      | Temp. (°C) | Life stage characteristics                    | Citation                                                                                  |
|----------------|----------------------------|----------------|------------------|-------------------|---------------|-----------------------|---------------------------|------------------------|--------------------|-------------------------------------------------|--------------------------------------|-----------------------------------------|---------|------------|-----------------------------------------------|-------------------------------------------------------------------------------------------|
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | LC <sub>50</sub> | Survival          | 792           | LT                    | P/S                       | F                      | 1001               | 97                                              | 58-66                                | 7.6                                     | 7.5     | 25         | 9 h from fertilization to Juvenile life stage | Birge <i>et al.</i> (1985)                                                                |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | LC <sub>10</sub> | Survival          | 792           | LT                    | P/S                       | F                      | 598                | 97                                              | 58-66                                | 7.6                                     | 7.5     | 25         | 9 h from fertilization to Juvenile life stage | Birge <i>et al.</i> (1985); Elphick <i>et al.</i> (2011a) calculation from available data |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | NOEC             | Mortality         | 168           | Chronic               | P/S                       | S                      | 1274               | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                                           | Diamond <i>et al.</i> (1992)                                                              |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | NOEC             | Mortality         | 168           | Chronic               | P/S                       | S                      | 2002               | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                                           | Diamond <i>et al.</i> (1992)                                                              |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | NOEC             | Mortality         | 168           | Chronic               | P/S                       | S                      | 1597               | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                                           | Diamond <i>et al.</i> (1992)                                                              |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | NOEC             | Mortality         | 168           | Chronic               | P/S                       | S                      | 1577               | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                                           | Diamond <i>et al.</i> (1992)                                                              |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | NOEC             | Mortality         | 168           | Chronic               | P/S                       | S                      | 2002               | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                                           | Diamond <i>et al.</i> (1992)                                                              |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | NOEC             | Mortality         | 168           | Chronic               | P/S                       | S                      | 1777               | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                                           | Diamond <i>et al.</i> (1992)                                                              |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | IC <sub>25</sub> | Biomass           | 792           | LT                    | P/S                       | SR                     | 704                | 85                                              | 58-60                                | N/S                                     | 7.4-7.8 | 25         | 36 h post fertilization                       | Elphick <i>et al.</i> (2011a)                                                             |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | IC <sub>50</sub> | Biomass           | 792           | LT                    | P/S                       | SR                     | 958                | 85                                              | 58-60                                | N/S                                     | 7.4-7.8 | 25         | 36 h post fertilization                       | Elphick <i>et al.</i> (2011a)                                                             |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | NOEC             | Biomass           | 792           | LT                    | P/S                       | SR                     | 558                | 85                                              | 58-60                                | N/S                                     | 7.4-7.8 | 25         | 36 h post fertilization                       | Elphick <i>et al.</i> (2011a)                                                             |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | LOEC             | Biomass           | 792           | LT                    | P/S                       | SR                     | 1058               | 85                                              | 58-60                                | N/S                                     | 7.4-7.8 | 25         | 36 h post fertilization                       | Elphick <i>et al.</i> (2011a)                                                             |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | NOEC             | Survival          | 168           | LT                    | P/S                       | S                      | 2427               | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 24 h old larva                                | Pickering <i>et al.</i> (1996)                                                            |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | NOEC             | Survival          | 168           | LT                    | P/S                       | S                      | 2427               | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 96 h old larva                                | Pickering <i>et al.</i> (1996)                                                            |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | NOEC             | Survival          | 168           | LT                    | P/S                       | S                      | 2427               | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 168 h old larva                               | Pickering <i>et al.</i> (1996)                                                            |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | NOEC             | Survival          | 168           | LT                    | P/S                       | S                      | 2427               | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 24 h old larva                                | Pickering <i>et al.</i> (1996)                                                            |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | NOEC             | Survival          | 168           | LT                    | P/S                       | S                      | 2427               | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 96 h old larva                                | Pickering <i>et al.</i> (1996)                                                            |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | NOEC             | Survival          | 168           | LT                    | P/S                       | S                      | 2427               | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 168 h old larva                               | Pickering <i>et al.</i> (1996)                                                            |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | LOEC             | Survival          | 168           | LT                    | P/S                       | S                      | 4853               | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 24 h old larva                                | Pickering <i>et al.</i> (1996)                                                            |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | LOEC             | Survival          | 168           | LT                    | P/S                       | S                      | 4853               | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 96 h old larva                                | Pickering <i>et al.</i> (1996)                                                            |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | LOEC             | Survival          | 168           | LT                    | P/S                       | S                      | 4853               | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 168 h old larva                               | Pickering <i>et al.</i> (1996)                                                            |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow | LOEC             | Survival          | 168           | LT                    | P/S                       | S                      | 4853               | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 24 h old larva                                | Pickering <i>et al.</i> (1996)                                                            |



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|----------------|----------------------------|--------------------|------------------|----------------------|---------------|-----------------------|---------------------------|------------------------|--------------------|-------------------------------------------------|--------------------------------------|-----------------------------------------|---------|------------|------------------------------------|--------------------------------|
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow     | LOEC             | Survival             | 168           | LT                    | P/S                       | S                      | 4853               | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 96 h old larva                     | Pickering <i>et al.</i> (1996) |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow     | LOEC             | Survival             | 168           | LT                    | P/S                       | S                      | 4853               | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 168 h old larva                    | Pickering <i>et al.</i> (1996) |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow     | NOEC             | Growth               | 168           | LT                    | P/S                       | S                      | 2427               | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 24 h old larva                     | Pickering <i>et al.</i> (1996) |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow     | NOEC             | Growth               | 168           | LT                    | P/S                       | S                      | 2427               | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 96 h old larva                     | Pickering <i>et al.</i> (1996) |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow     | NOEC             | Growth               | 168           | LT                    | P/S                       | S                      | 2427               | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 168 h old larva                    | Pickering <i>et al.</i> (1996) |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow     | NOEC             | Growth               | 168           | LT                    | P/S                       | S                      | 2427               | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 24 h old larva                     | Pickering <i>et al.</i> (1996) |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow     | NOEC             | Growth               | 168           | LT                    | P/S                       | S                      | 2427               | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 96 h old larva                     | Pickering <i>et al.</i> (1996) |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow     | NOEC             | Growth               | 168           | LT                    | P/S                       | S                      | 2427               | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 168 h old larva                    | Pickering <i>et al.</i> (1996) |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow     | MATC             | Biomass (Population) | 168           | LT                    | P/S                       | S                      | 3458               | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 24 h old larva                     | Pickering <i>et al.</i> (1996) |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow     | MATC             | Growth               | 816           | LT                    | P/S                       | SR                     | 768                | 90                                              | 52-60                                | 4.9-9.6                                 | 7.3-8.2 | 24-26      | Embryo (< 3 h since fertilization) | Rescan (2007)                  |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow     | NOEC             | Mortality            | 816           | LT                    | P/S                       | SR                     | 558                | 90                                              | 52-60                                | 4.9-9.6                                 | 7.3-8.2 | 24-26      | Embryo (< 3 h since fertilization) | Rescan (2007)                  |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow     | LOEC             | Mortality            | 816           | LT                    | P/S                       | SR                     | 1058               | 90                                              | 52-60                                | 4.9-9.6                                 | 7.3-8.2 | 24-26      | Embryo (< 3 h since fertilization) | Rescan (2007)                  |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow     | MATC             | Mortality            | 816           | LT                    | P/S                       | SR                     | 768                | 90                                              | 52-60                                | 4.9-9.6                                 | 7.3-8.2 | 24-26      | Embryo (< 3 h since fertilization) | Rescan (2007)                  |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow     | LC <sub>50</sub> | Mortality            | 816           | Chronic               | P/S                       | SR                     | 792                | 90                                              | 52-60                                | 4.9-9.6                                 | 7.3-8.2 | 24-26      | Embryo (< 3 h since fertilization) | Rescan (2007)                  |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow     | LC <sub>25</sub> | Mortality            | 816           | LT                    | P/S                       | SR                     | 699                | 90                                              | 52-60                                | 4.9-9.6                                 | 7.3-8.2 | 24-26      | Embryo (< 3 h since fertilization) | Rescan (2007)                  |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow     | LC <sub>10</sub> | Mortality            | 816           | LT                    | P/S                       | SR                     | 585                | 90                                              | 52-60                                | 4.9-9.6                                 | 7.3-8.2 | 24-26      | Embryo (< 3 h since fertilization) | Rescan (2007)                  |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow     | LC <sub>10</sub> | Mortality            | 168           | LT                    | U                         | S                      | 1638               | 40                                              | 38                                   | 8.8                                     | 6.7     | 25.3       | 24 h old larva                     | UGARF (2016a)                  |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow     | LC <sub>10</sub> | Mortality            | 168           | LT                    | U                         | S                      | 2912               | 80                                              | 74                                   | 9.0                                     | 7.0     | 25.3       | 24 h old larva                     | UGARF (2016a)                  |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow     | LC <sub>10</sub> | Mortality            | 168           | LT                    | U                         | S                      | 2669               | 164                                             | 158                                  | 8.7                                     | 7.6     | 26.3       | 24 h old larva                     | UGARF (2016a)                  |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow     | LC <sub>10</sub> | Mortality            | 168           | LT                    | U                         | S                      | 1432               | 198                                             | 188                                  | 7.9                                     | 8.2     | 26.2       | 24 h old larva                     | UGARF (2016a)                  |
| Actinopterygii | <i>Pimephales promelas</i> | Fathead minnow     | LC <sub>50</sub> | Mortality            | 168           | LT                    | U                         | S                      | 1428               | 272                                             | 274                                  | 7.7                                     | 8.6     | 26         | 24 h old larva                     | UGARF (2016a)                  |
| Actinopterygii | <i>Salmo trutta</i>        | Brown trout        | NOEC             | Mortality            | 192           | LT                    | P/S                       | S                      | 607                | 23                                              | 32                                   | 10                                      | 7.63    | 15-16      | Fingering (1440 h old)             | Camargo & Tarazona (1991)      |
| Amphibia       | <i>Ambystoma maculatum</i> | Spotted salamander | LOEC             | Growth               | 1200          | LT                    | U (pond water used)       | SR                     | 300                | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | Tadpole to metamorphosis           | Collins (2010)                 |

Table A-1. LONG-TERM/ CHRONIC DATA - NaCl, KCl, CaCl<sub>2</sub>, and MgCl<sub>2</sub> SALTS

| Class    | Species                           | Common name           | Endpoint         | Endpoint criteria                    | Exp. time (h) | LT (SSD) <sup>A</sup> | Data quality <sup>B</sup>               | Exp. type <sup>C</sup> | Chloride (mg Cl/L) | Hardness <sup>D</sup> (mg CaCO <sub>3</sub> /L) | Alkalinity (mg CaCO <sub>3</sub> /L) | Dissolved oxygen (mg O <sub>2</sub> /L) | pH  | Temp. (°C) | Life stage characteristics   | Citation                 |
|----------|-----------------------------------|-----------------------|------------------|--------------------------------------|---------------|-----------------------|-----------------------------------------|------------------------|--------------------|-------------------------------------------------|--------------------------------------|-----------------------------------------|-----|------------|------------------------------|--------------------------|
| Amphibia | <i>Ambystoma maculatum</i>        | Spotted salamander    | LOEC             | Development                          | 1200          | LT                    | U (pond water used)                     | SR                     | 300                | N/S                                             | N/S                                  | N/S                                     | N/S | N/S        | Tadpole to metamorphosis     | Collins (2010)           |
| Amphibia | <i>Ambystoma maculatum</i>        | Spotted salamander    | LOEC             | Physiology (decrease in clutch mass) | 432           | LT                    | U (Road deicing salt used)              | S                      | 145                | 120                                             | N/S                                  | N/S                                     | N/S | 11         | egg/embryo                   | Karraker & Gibbs (2011)  |
| Amphibia | <i>Ambystoma maculatum</i>        | Spotted salamander    | EC <sub>45</sub> | Physiology (decrease in clutch mass) | 432           | LT                    | U (Road deicing salt used)              | S                      | 945                | 120                                             | N/S                                  | N/S                                     | N/S | 11         | egg/embryo                   | Karraker & Gibbs (2011)  |
| Amphibia | <i>Ambystoma maculatum</i>        | Spotted salamander    | LOEC             | Mortality                            | 924           | LT                    | U (Road deicing salt used)              | SR                     | 145                | N/S                                             | N/S                                  | N/S                                     | 5.4 | 18         | egg/embryo (12 h since fert) | Karraker & Ruthig (2009) |
| Amphibia | <i>Ambystoma maculatum</i>        | Spotted salamander    | LOEC             | Development                          | 924           | LT                    | U (Road deicing salt used)              | SR                     | 945                | N/S                                             | N/S                                  | N/S                                     | 5.4 | 18         | egg/embryo (12 h since fert) | Karraker & Ruthig (2009) |
| Amphibia | <i>Anaxyrus americanus</i>        | American toad         | LOEC             | Development                          | 48-192        | LT                    | U (pond water used)                     | SR                     | 900                | N/S                                             | N/S                                  | N/S                                     | N/S | 8.0-12     | egg/embryo to hatching       | Collins (2010)           |
| Amphibia | <i>Limnodynastes tasmaniensis</i> | Spotted Grass Frog    | LC <sub>50</sub> | Mortality                            | 1080          | Chronic               | U (Tropical species)                    | SR                     | 2998               | 984                                             | N/S                                  | N/S                                     | N/S | 20         | Tadpole                      | Kearney et al. (2012)    |
| Amphibia | <i>Lithobates pipiens</i>         | Northern Leopard frog | NOEC             | Development                          | 2592          | LT                    | P/S                                     | S                      | 1941               | 90                                              | N/S                                  | N/S                                     | N/S | 21-25      | Egg/Embryo                   | Doe (2010)               |
| Amphibia | <i>Lithobates pipiens</i>         | Northern Leopard frog | NOEC             | Growth                               | 2592          | LT                    | P/S                                     | S                      | 1941               | 90                                              | N/S                                  | N/S                                     | N/S | 21-25      | Egg/Embryo                   | Doe (2010)               |
| Amphibia | <i>Lithobates pipiens</i>         | Northern Leopard frog | NOEC             | Mortality                            | 2592          | LT                    | P/S                                     | S                      | 1941               | 90                                              | N/S                                  | N/S                                     | N/S | 21-25      | Egg/Embryo                   | Doe (2010)               |
| Amphibia | <i>Lithobates pipiens</i>         | Northern Leopard frog | LOEC             | Mortality                            | 2592          | LT                    | P/S                                     | S                      | 6066               | 90                                              | N/S                                  | N/S                                     | N/S | 21-25      | Egg/Embryo                   | Doe (2010)               |
| Amphibia | <i>Lithobates pipiens</i>         | Northern Leopard frog | MATC             | Mortality                            | 2592          | LT                    | P/S                                     | S                      | 3431               | 90                                              | N/S                                  | N/S                                     | N/S | 21-25      | Egg/Embryo                   | Doe (2010)               |
| Amphibia | <i>Lithobates pipiens</i>         | Northern Leopard frog | LC <sub>50</sub> | Mortality                            | 168           | Chronic               | P/S                                     | S                      | 3397               | 90                                              | N/S                                  | N/S                                     | N/S | 21-25      | Egg/Embryo                   | Doe (2010)               |
| Amphibia | <i>Lithobates pipiens</i>         | Northern Leopard frog | LC <sub>50</sub> | Mortality                            | 4320          | Chronic               | P/S                                     | S                      | 2265               | 90                                              | N/S                                  | N/S                                     | N/S | 21-25      | Egg/Embryo                   | Doe (2010)               |
| Amphibia | <i>Lithobates pipiens</i>         | Northern Leopard frog | LC <sub>10</sub> | Mortality                            | 2592          | LT                    | U (LC <sub>10</sub> >LC <sub>50</sub> ) | S                      | 4233               | 90                                              | N/S                                  | N/S                                     | N/S | 21-25      | Egg/Embryo                   | Doe (2010)               |
| Amphibia | <i>Lithobates pipiens</i>         | Northern Leopard frog | EC <sub>20</sub> | Biomass                              | 2040          | LT                    | P/S                                     | SR                     | 801                | 8                                               | 9.1                                  | N/S                                     | N/S | 23         | Tadpole (Goshier stage 25)   | Nautilus (2016)          |
| Amphibia | <i>Lithobates pipiens</i>         | Northern Leopard frog | LC <sub>20</sub> | Mortality                            | 2040          | LT                    | P/S                                     | SR                     | 2471               | 8                                               | 9.1                                  | N/S                                     | N/S | 23         | Tadpole (Goshier stage 25)   | Nautilus (2016)          |
| Amphibia | <i>Lithobates pipiens</i>         | Northern Leopard frog | EC <sub>20</sub> | Dry weight                           | 2040          | LT                    | P/S                                     | SR                     | 2282               | 8                                               | 9.1                                  | N/S                                     | N/S | 23         | Tadpole (Goshier stage 25)   | Nautilus (2016)          |
| Amphibia | <i>Lithobates pipiens</i>         | Northern Leopard frog | EC <sub>20</sub> | Length, total                        | 2040          | LT                    | P/S                                     | SR                     | 4164               | 8                                               | 9.1                                  | N/S                                     | N/S | 23         | Tadpole (Goshier stage 25)   | Nautilus (2016)          |
| Amphibia | <i>Lithobates pipiens</i>         | Northern Leopard frog | EC <sub>20</sub> | Length, snout to vent                | 2040          | LT                    | P/S                                     | SR                     | 4274               | 8                                               | 9.1                                  | N/S                                     | N/S | 23         | Tadpole (Goshier stage 25)   | Nautilus (2016)          |
| Amphibia | <i>Lithobates pipiens</i>         | Northern Leopard frog | EC <sub>20</sub> | Biomass                              | 2136          | LT                    | P/S                                     | SR                     | 2723               | 90                                              | 73.5                                 | N/S                                     | N/S | 23         | Tadpole (Goshier stage 25)   | Nautilus (2016)          |
| Amphibia | <i>Lithobates pipiens</i>         | Northern Leopard frog | LC <sub>20</sub> | Mortality                            | 2136          | LT                    | P/S                                     | SR                     | 2609               | 90                                              | 73.5                                 | N/S                                     | N/S | 23         | Tadpole (Goshier stage 25)   | Nautilus (2016)          |

Table A-1. LONG-TERM/ CHRONIC DATA - NaCl, KCl, CaCl<sub>2</sub>, and MgCl<sub>2</sub> SALTS

| Class    | Species                      | Common name                | Endpoint         | Endpoint criteria     | Exp. time (h) | LT (SSD) <sup>A</sup> | Data quality <sup>B</sup>            | Exp. type <sup>C</sup> | Chloride (mg Cl <sup>-</sup> /L) | Hardness <sup>D</sup> (mg CaCO <sub>3</sub> /L) | Alkalinity (mg CaCO <sub>3</sub> /L) | Dissolved oxygen (mg O <sub>2</sub> /L) | pH      | Temp. (°C) | Life stage characteristics | Citation                   |
|----------|------------------------------|----------------------------|------------------|-----------------------|---------------|-----------------------|--------------------------------------|------------------------|----------------------------------|-------------------------------------------------|--------------------------------------|-----------------------------------------|---------|------------|----------------------------|----------------------------|
| Amphibia | <i>Lithobates pipiens</i>    | Northern Leopard frog      | EC <sub>20</sub> | Dry weight            | 2136          | LT                    | P/S                                  | SR                     | 4180                             | 90                                              | 73.5                                 | N/S                                     | N/S     | 23         | Tadpole (Gosher stage 25)  | Nautilus (2016)            |
| Amphibia | <i>Lithobates pipiens</i>    | Northern Leopard frog      | EC <sub>20</sub> | Length, total         | 2136          | LT                    | P/S                                  | SR                     | 2740                             | 90                                              | 73.5                                 | N/S                                     | N/S     | 23         | Tadpole (Gosher stage 25)  | Nautilus (2016)            |
| Amphibia | <i>Lithobates pipiens</i>    | Northern Leopard frog      | EC <sub>20</sub> | Length, snout to vent | 2136          | LT                    | P/S                                  | SR                     | 4168                             | 90                                              | 73.5                                 | N/S                                     | N/S     | 23         | Tadpole (Gosher stage 25)  | Nautilus (2016)            |
| Amphibia | <i>Lithobates pipiens</i>    | Northern Leopard frog      | EC <sub>20</sub> | Biomass               | 2136          | LT                    | P/S                                  | SR                     | 2800                             | 300                                             | 207.5                                | N/S                                     | N/S     | 23         | Tadpole (Gosher stage 25)  | Nautilus (2016)            |
| Amphibia | <i>Lithobates pipiens</i>    | Northern Leopard frog      | LC <sub>20</sub> | Mortality             | 2136          | LT                    | P/S                                  | SR                     | 2800                             | 300                                             | 207.5                                | N/S                                     | N/S     | 23         | Tadpole (Gosher stage 25)  | Nautilus (2016)            |
| Amphibia | <i>Lithobates pipiens</i>    | Northern Leopard frog      | EC <sub>20</sub> | Dry weight            | 2136          | LT                    | P/S                                  | SR                     | 4321                             | 300                                             | 207.5                                | N/S                                     | N/S     | 23         | Tadpole (Gosher stage 25)  | Nautilus (2016)            |
| Amphibia | <i>Lithobates pipiens</i>    | Northern Leopard frog      | EC <sub>20</sub> | Length, total         | 2136          | LT                    | P/S                                  | SR                     | 4168                             | 300                                             | 207.5                                | N/S                                     | N/S     | 23         | Tadpole (Gosher stage 25)  | Nautilus (2016)            |
| Amphibia | <i>Lithobates pipiens</i>    | Northern Leopard frog      | EC <sub>20</sub> | Length, snout to vent | 2136          | LT                    | P/S                                  | SR                     | 4234                             | 300                                             | 207.5                                | N/S                                     | N/S     | 23         | Tadpole (Gosher stage 25)  | Nautilus (2016)            |
| Amphibia | <i>Lithobates sylvaticus</i> | Wood frog                  | LOEC             | Development           | 420           | LT                    | U (pond water used)                  | SR                     | 900                              | N/S                                             | N/S                                  | N/S                                     | N/S     | 8.0-12     | Egg/embryo to hatching     | Collins (2010)             |
| Amphibia | <i>Lithobates sylvaticus</i> | Wood frog                  | LOEC             | Mortality             | 240           | LT                    | U (Control mortality >10% at day 10) | SR                     | 625                              | N/S                                             | N/S                                  | N/S                                     | N/S     | 19         | Tadpole                    | Sanzo & Hecnar (2006)      |
| Amphibia | <i>Lithobates sylvaticus</i> | Wood frog                  | MATC             | Mortality             | 240           | LT                    | U (Control mortality >10% at day 10) | SR                     | 171                              | N/S                                             | N/S                                  | N/S                                     | N/S     | 19         | Tadpole                    | Sanzo & Hecnar (2006)      |
| Amphibia | <i>Litoria aurea</i>         | Green and golden bell frog | LOEC             | Growth (mean weight)  | 120           | Chronic               | U (Tropical species)                 | S                      | 890                              | 292                                             | N/S                                  | N/S                                     | N/S     | 17.7-25.1  | N/S                        | Christy & Dickman (2002)   |
| Amphibia | <i>Litoria ewingii</i>       | Brown tree frog            | LC <sub>50</sub> | Mortality             | 720           | Chronic               | U (Tropical species)                 | S                      | 3397                             | 1234                                            | N/S                                  | N/S                                     | N/S     | 22         | Tadpole                    | Chinathambet et al. (2006) |
| Amphibia | <i>Neobatrachus sudelli</i>  | Sudell's Frog              | LC <sub>50</sub> | Mortality             | 1500          | Chronic               | U (Tropical species)                 | SR                     | 2998                             | 984                                             | N/S                                  | N/S                                     | N/S     | 20         | Tadpole                    | Kearney et al. (2012)      |
| Amphibia | <i>Rana clamitans</i>        | Green frog                 | LC <sub>50</sub> | Mortality             | 168           | Chronic               | P/S                                  | S                      | 246                              | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | Tadpole                    | Dougherty & Smith (2006)   |
| Amphibia | <i>Rana clamitans</i>        | Green frog                 | LOEC             | Development           | 58            | Chronic               | U (Road deicing salt used)           | SR                     | 945                              | N/S                                             | N/S                                  | N/S                                     | 6.87    | 18-20      | Egg/embryo                 | Karraker (2007)            |
| Amphibia | <i>Rana clamitans</i>        | Green frog                 | LOEC             | Mortality             | 168           | LT                    | U (Road deicing salt used)           | SR                     | 945                              | N/S                                             | N/S                                  | N/S                                     | 6.87    | 18-20      | Egg/embryo to hatching     | Karraker (2007)            |
| Amphibia | <i>Rana sylvaticus</i>       | Wood frog                  | Survival         | Survival              | 1680          | LT                    | U (Field data using road salt)       | N/S                    | 145                              | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Karraker et al. (2008)     |
| Amphibia | <i>Rana sylvaticus</i>       | Wood frog                  | Survival         | Survival              | 1680          | LT                    | U (Field data using road salt)       | N/S                    | 945                              | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Karraker et al. (2008)     |
| Amphibia | <i>Rana temporaria</i>       | European common frog       | NOEC             | Mortality             | 1344          | LT                    | P/S                                  | SR                     | 940                              | 42                                              | N/S                                  | N/S                                     | 7.2-7.6 | 16         | Tadpole                    | Denoe et al. (2010)        |
| Amphibia | <i>Rana temporaria</i>       | European common frog       | NOEC             | Growth                | 1344          | LT                    | P/S                                  | SR                     | 910                              | 42                                              | N/S                                  | N/S                                     | 7.2-7.6 | 16         | Tadpole                    | Denoe et al. (2010)        |
| Amphibia | <i>Rana temporaria</i>       | European common frog       | NOEC             | Mean swimming speed   | 1008          | Chronic               | P/S                                  | SR                     | 607                              | 42                                              | N/S                                  | N/S                                     | 7.2-7.6 | 16         | Tadpole                    | Denoe et al. (2010)        |
| Amphibia | <i>Rana temporaria</i>       | European common frog       | LOEC             | Mean swimming speed   | 1008          | Chronic               | P/S                                  | SR                     | 910                              | 42                                              | N/S                                  | N/S                                     | 7.2-7.6 | 16         | Tadpole                    | Denoe et al. (2010)        |

Table A-1. LONG-TERM/ CHRONIC DATA - NaCl, KCl, CaCl<sub>2</sub>, and MgCl<sub>2</sub> SALTS

| Class    | Species                     | Common name          | Endpoint         | Endpoint criteria                      | Exp. time (h) | LT (SSD) <sup>A</sup> | Data quality <sup>B</sup> | Exp. type <sup>C</sup> | Chloride (mg Cl/L) | Hardness <sup>D</sup> (mg CaCO <sub>3</sub> /L) | Alkalinity (mg CaCO <sub>3</sub> /L) | Dissolved oxygen (mg O <sub>2</sub> /L) | pH      | Temp. (°C) | Life stage characteristics | Citation                                                                    |
|----------|-----------------------------|----------------------|------------------|----------------------------------------|---------------|-----------------------|---------------------------|------------------------|--------------------|-------------------------------------------------|--------------------------------------|-----------------------------------------|---------|------------|----------------------------|-----------------------------------------------------------------------------|
| Amphibia | <i>Rana temporaria</i>      | European common frog | NOEC             | Mean swimming speed                    | 1344          | Chronic               | P/S                       | SR                     | 303                | 42                                              | N/S                                  | N/S                                     | 7.2-7.6 | 16         | Tadpole                    | Denoel et al. (2010)                                                        |
| Amphibia | <i>Rana temporaria</i>      | European common frog | LOEC             | Mean swimming speed                    | 1344          | Chronic               | P/S                       | SR                     | 607                | 42                                              | N/S                                  | N/S                                     | 7.2-7.6 | 16         | Tadpole                    | Denoel et al. (2010)                                                        |
| Amphibia | <i>Rana temporaria</i>      | European common frog | EC <sub>10</sub> | Swimming speed (linear interpretation) | 1344          | Chronic               | P/S                       | SR                     | 377                | 42                                              | N/S                                  | N/S                                     | 7.2-7.6 | 16         | Tadpole                    | Denoel et al. (2010)                                                        |
| Amphibia | <i>Rana temporaria</i>      | European common frog | NOEC             | Total distance moved                   | 1344          | Chronic               | P/S                       | SR                     | 303                | 42                                              | N/S                                  | N/S                                     | 7.2-7.6 | 16         | Tadpole                    | Denoel et al. (2010)                                                        |
| Amphibia | <i>Rana temporaria</i>      | European common frog | LOEC             | Total distance moved                   | 1344          | Chronic               | P/S                       | SR                     | 607                | 42                                              | N/S                                  | N/S                                     | 7.2-7.6 | 16         | Tadpole                    | Denoel et al. (2010)                                                        |
| Amphibia | <i>Rana temporaria</i>      | European common frog | EC <sub>10</sub> | Total distance moved                   | 1344          | Chronic               | P/S                       | SR                     | 292                | 42                                              | N/S                                  | N/S                                     | 7.2-7.6 | 16         | Tadpole                    | Denoel et al. (2010)                                                        |
| Amphibia | <i>Rana temporaria</i>      | European common frog | MATC             | Mean swimming speed                    | 1008          | Chronic               | P/S                       | SR                     | 743                | 42                                              | N/S                                  | N/S                                     | 7.2-7.6 | 16         | Tadpole                    | Denoel et al. (2010)                                                        |
| Amphibia | <i>Rana temporaria</i>      | European common frog | MATC             | Mean swimming speed                    | 1344          | Chronic               | P/S                       | SR                     | 429                | 42                                              | N/S                                  | N/S                                     | 7.2-7.6 | 16         | Tadpole                    | Denoel et al. (2010)                                                        |
| Amphibia | <i>Rana temporaria</i>      | European common frog | MATC             | Total distance moved                   | 1344          | Chronic               | P/S                       | SR                     | 429                | 42                                              | N/S                                  | N/S                                     | 7.2-7.6 | 16         | Tadpole                    | Denoel et al. (2010)                                                        |
| Amphibia | <i>Xenopus laevis</i>       | African clawed frog  | NOEC             | Mortality                              | 168           | LT                    | P/S                       | SR                     | 1213               | 115                                             | 80-90                                | >8                                      | 7.7-8.3 | 23         | Tadpole (336 h old)        | Beak International Inc. (1999)                                              |
| Amphibia | <i>Xenopus laevis</i>       | African clawed frog  | LOEC             | Mortality                              | 168           | LT                    | P/S                       | SR                     | 2426               | 115                                             | 80-90                                | >8                                      | 7.7-8.3 | 23         | Tadpole (336 h old)        | Beak International Inc. (1999)                                              |
| Amphibia | <i>Xenopus laevis</i>       | African clawed frog  | MATC             | Mortality                              | 168           | LT                    | P/S                       | SR                     | 1715               | 115                                             | 80-90                                | >8                                      | 7.7-8.3 | 23         | Tadpole (336 h old)        | Beak International Inc. (1999)                                              |
| Amphibia | <i>Xenopus laevis</i>       | African clawed frog  | LC <sub>10</sub> | Mortality                              | 168           | LT                    | P/S                       | SR                     | 1307               | 115                                             | 80-90                                | >8                                      | 7.7-8.3 | 23         | Tadpole (336 h old)        | Beak International Inc. (1999); CCME (2011) calculation from available data |
| Amphibia | <i>Xenopus laevis</i>       | African clawed frog  | LC <sub>50</sub> | Mortality                              | 168           | Chronic               | P/S                       | SR                     | 1783               | 115                                             | 80-90                                | >8                                      | 7.7-8.3 | 23         | Egg/Embryo                 | Beak International Inc. (1999)                                              |
| Amphibia | <i>Xenopus laevis</i>       | African clawed frog  | EC <sub>50</sub> | Physiological (impaired swimming)      | 168           | LT                    | P/S                       | SR                     | 1523               | 115                                             | 80-90                                | >8                                      | 7.7-8.3 | 23         | Egg/Embryo                 | Beak International Inc. (1999)                                              |
| Amphibia | <i>Xenopus laevis</i>       | African clawed frog  | LC <sub>50</sub> | Mortality                              | 168           | Chronic               | P/S                       | S                      | 799                | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | Tadpole                    | Dougherty & Smith (2006)                                                    |
| Bivalvia | <i>Anodonta subangulata</i> | Freshwater mussel    | EC <sub>10</sub> | Glochidia functional survival          | 24            | LT                    | P/S                       | S                      | 1262               | 42                                              | 42                                   | 8.9                                     | 7.8     | 20.2       | Glochidia                  | UGARF (2016a)                                                               |
| Bivalvia | <i>Anodonta subangulata</i> | Freshwater mussel    | EC <sub>10</sub> | Glochidia functional survival          | 24            | LT                    | P/S                       | S                      | 877                | 78                                              | 76                                   | 8.9                                     | 8.1     | 20.5       | Glochidia                  | UGARF (2016a)                                                               |
| Bivalvia | <i>Anodonta subangulata</i> | Freshwater mussel    | EC <sub>10</sub> | Glochidia functional survival          | 24            | LT                    | P/S                       | S                      | 1429               | 150                                             | 144                                  | 8.7                                     | 8.4     | 20.5       | Glochidia                  | UGARF (2016a)                                                               |

Table A-1. LONG-TERM/ CHRONIC DATA - NaCl, KCl, CaCl<sub>2</sub>, and MgCl<sub>2</sub> SALTS

| Class             | Species                             | Common name       | Endpoint         | Endpoint criteria             | Exp. time (h) | LT (SSD) <sup>A</sup> | Data quality <sup>B</sup>                                                                                            | Exp. type <sup>C</sup> | Chloride (mg Cl <sup>-</sup> /L) | Hardness <sup>D</sup> (mg CaCO <sub>3</sub> /L) | Alkalinity (mg CaCO <sub>3</sub> /L) | Dissolved oxygen (mg O <sub>2</sub> /L) | pH      | Temp. (°C) | Life stage characteristics | Citation                                                            |
|-------------------|-------------------------------------|-------------------|------------------|-------------------------------|---------------|-----------------------|----------------------------------------------------------------------------------------------------------------------|------------------------|----------------------------------|-------------------------------------------------|--------------------------------------|-----------------------------------------|---------|------------|----------------------------|---------------------------------------------------------------------|
| Bivalvia          | <i>Anodonta subangulata</i>         | Freshwater mussel | EC <sub>10</sub> | Glochidia functional survival | 24            | LT                    | P/S                                                                                                                  | S                      | 2246                             | 310                                             | 278                                  | 8.9                                     | 8.5     | 20.5       | Glochidia                  | UGARF (2016a)                                                       |
| Bivalvia          | <i>Anodonta subangulata</i>         | Freshwater mussel | EC <sub>10</sub> | Glochidia functional survival | 24            | LT                    | P/S                                                                                                                  | S                      | 2701                             | 548                                             | 376                                  | 8.9                                     | 8.1     | 20.5       | Glochidia                  | UGARF (2016a)                                                       |
| Bacillariophyceae | <i>Navicula seminulum</i>           | Diatom            | LC <sub>50</sub> | Mortality                     | 96            | LT                    | P/S                                                                                                                  | S                      | 1474                             | 10                                              | N/S                                  | 8                                       | N/S     | 22         | N/S                        | Academy of Natural Sciences (1960)                                  |
| Bacillariophyceae | <i>Nitzschia linearis</i>           | Diatom            | LC <sub>50</sub> | Mortality                     | 120           | Chronic               | ? U (control survival not reported)                                                                                  | S                      | 1474                             | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Patrick et al. (1968)                                               |
| Bivalvia          | <i>Elliptio complanata</i>          | Freshwater mussel | EC <sub>10</sub> | Survival                      | 24            | LT                    | P/S                                                                                                                  | S                      | 406                              | 169                                             | 116-130                              | >80 % sat                               | 8.3-8.6 | 20.1-21.9  | Glochidia                  | Bringolf et al. (2010); CCME (2011) calculation from available data |
| Bivalvia          | <i>Elliptio complanata</i>          | Freshwater mussel | EC <sub>10</sub> | Survival                      | 48            | LT                    | U (as per CCME (2011), only < 24h glochidia exposures valid)                                                         | S                      | 91                               | 169                                             | 116-130                              | >80 % sat                               | 8.3-8.6 | 20.1-21.9  | Glochidia                  | Bringolf et al. (2010)                                              |
| Bivalvia          | <i>Epioblasma torulosa rangiana</i> | Freshwater mussel | EC <sub>30</sub> | Glochidia functional survival | 24            | LT                    | ? (data not presented in Gillis 2011)                                                                                | S                      | 161                              | 105 (95-115)                                    | N/S                                  | N/S                                     | N/S     | 21         | Glochidia                  | Gillis (2009) [Cited as Gillis (2011) in CCME 2011]                 |
| Bivalvia          | <i>Epioblasma torulosa rangiana</i> | Freshwater mussel | EC <sub>20</sub> | Glochidia functional survival | 24            | LT                    | ? (data not presented in Gillis 2011)                                                                                | S                      | 111                              | 105 (95-115)                                    | N/S                                  | N/S                                     | N/S     | 21         | Glochidia                  | Gillis (2009) [Cited as Gillis (2011) in CCME (2011)]               |
| Bivalvia          | <i>Epioblasma torulosa rangiana</i> | Freshwater mussel | EC <sub>10</sub> | Glochidia functional survival | 24            | LT                    | P/S                                                                                                                  | S                      | 42                               | 105 (95-115)                                    | N/S                                  | N/S                                     | N/S     | 21         | Glochidia                  | Gillis (2009); CCME (2011) calculation from available data          |
| Bivalvia          | <i>Lampsilis fasciola</i>           | Freshwater mussel | EC <sub>10</sub> | Survival                      | 24            | LT                    | P/S                                                                                                                  | S                      | 24                               | 169                                             | 116-130                              | >80 % sat                               | 8.3-8.6 | 20.1-21.9  | Glochidia                  | Bringolf et al. (2010); CCME (2011) calculation from available data |
| Bivalvia          | <i>Lampsilis fasciola</i>           | Freshwater mussel | EC <sub>10</sub> | Survival                      | 96            | LT                    | P/S                                                                                                                  | S                      | 601                              | 169                                             | 116-130                              | >80 % sat                               | 8.3-8.6 | 20.1-21.9  | Juvenile (mussel stage)    | Bringolf et al. (2007)                                              |
| Bivalvia          | <i>Lampsilis fasciola</i>           | Freshwater mussel | EC <sub>10</sub> | Glochidia functional survival | 48            | LT                    | ? U (as per CCME (2011), only < 24h glochidia exposures valid)                                                       | S                      | 2                                | 169                                             | 116-130                              | >80 % sat                               | 8.3-8.6 | 20.1-21.9  | Glochidia                  | Bringolf et al. (2010) [as reported in CCME 2011]                   |
| Bivalvia          | <i>Lampsilis fasciola</i>           | Freshwater mussel | EC <sub>30</sub> | Glochidia functional survival | 48            | LT                    | ? U [Grand River (test subject collection site) Cl- = 66.8 mg/L (7 fold higher than estimated effect concentration)] | S                      | 8.6                              | 105 (95-115)                                    | N/S                                  | N/S                                     | N/S     | 21         | Glochidia                  | Gillis (2009) [Cited as Gillis (2011) in CCME (2011)]               |
| Bivalvia          | <i>Lampsilis fasciola</i>           | Freshwater mussel | EC <sub>10</sub> | Glochidia functional survival | 24            | LT                    | P/S                                                                                                                  | S                      | 247                              | 44                                              | 42                                   | 9.3                                     | 8.2     | 20.3       | Glochidia                  | UGARF (2016a)                                                       |
| Bivalvia          | <i>Lampsilis fasciola</i>           | Freshwater mussel | EC <sub>10</sub> | Glochidia functional survival | 24            | LT                    | P/S                                                                                                                  | S                      | 212                              | 80                                              | 80                                   | 9.3                                     | 8.3     | 20.1       | Glochidia                  | UGARF (2016a)                                                       |

Table A-1. LONG-TERM/ CHRONIC DATA - NaCl, KCl, CaCl<sub>2</sub>, and MgCl<sub>2</sub> SALTS

| Class    | Species                      | Common name       | Endpoint         | Endpoint criteria             | Exp. time (h) | LT (SSD) <sup>A</sup> | Data quality <sup>B</sup>                                                                                                                                                                                                    | Exp. type <sup>C</sup> | Chloride (mg Cl/L) | Hardness <sup>D</sup> (mg CaCO <sub>3</sub> /L) | Alkalinity (mg CaCO <sub>3</sub> /L) | Dissolved oxygen (mg O <sub>2</sub> /L) | pH      | Temp. (°C) | Life stage characteristics | Citation                                                                   |
|----------|------------------------------|-------------------|------------------|-------------------------------|---------------|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|--------------------|-------------------------------------------------|--------------------------------------|-----------------------------------------|---------|------------|----------------------------|----------------------------------------------------------------------------|
| Bivalvia | <i>Lampsilis fasciola</i>    | Freshwater mussel | EC <sub>10</sub> | Glochidia functional survival | 24            | LT                    | U (low glochidia number)                                                                                                                                                                                                     | S                      | 76                 | 188                                             | 164                                  | 9.3                                     | 8.6     | 20.4       | Glochidia                  | UGARF (2016a)                                                              |
| Bivalvia | <i>Lampsilis fasciola</i>    | Freshwater mussel | EC <sub>10</sub> | Glochidia functional survival | 24            | LT                    | P/S                                                                                                                                                                                                                          | S                      | 964                | 324                                             | 292                                  | 9                                       | 8.7     | 20.8       | Glochidia                  | UGARF (2016a)                                                              |
| Bivalvia | <i>Lampsilis siliquoidea</i> | Freshwater mussel | EC <sub>10</sub> | Survival                      | 96            | LT                    | P/S                                                                                                                                                                                                                          | S                      | 1474               | 169                                             | 116-130                              | >80 % sat                               | 8.3-8.6 | 20.1-21.9  | Juvenile (mussel stage)    | Bringolf <i>et al.</i> (2010); CCME (2011) calculation from available data |
| Bivalvia | <i>Lampsilis siliquoidea</i> | Freshwater mussel | EC <sub>30</sub> | Glochidia functional survival | 24            | LT                    | ? , U (2008 data did not meet ASTM 90% control survival requirement)                                                                                                                                                         | S                      | 35                 | 105 (95-115)                                    | N/S                                  | N/S                                     | N/S     | 21         | Glochidia                  | Gillis (2009) [Cited as Gillis (2011) in CCME (2011)]                      |
| Bivalvia | <i>Lampsilis siliquoidea</i> | Freshwater mussel | EC <sub>30</sub> | Glochidia functional survival | 24            | LT                    | ? (data not presented in Gillis 2011)                                                                                                                                                                                        | S                      | 117                | 105 (95-115)                                    | N/S                                  | N/S                                     | N/S     | 21         | Glochidia                  | Gillis (2009) [Cited as Gillis (2011) in CCME (2011)]                      |
| Bivalvia | <i>Lampsilis siliquoidea</i> | Freshwater mussel | EC <sub>20</sub> | Glochidia functional survival | 24            | LT                    | ? , U (1. If 2008 data, does not meet ASTM control survival requirements; or 2. If 2009 data, Maitland River (test subject collection site) Cl <sup>-</sup> = 57.4 mg/L (~3 fold higher than estimated effect concentration) | S                      | 20                 | 105 (95-115)                                    | N/S                                  | N/S                                     | N/S     | 21         | Glochidia                  | Gillis (2009) [Cited as Gillis (2011) in CCME (2011)]                      |
| Bivalvia | <i>Lampsilis siliquoidea</i> | Freshwater mussel | EC <sub>20</sub> | Dry weight                    | 672           | LT                    | P/S                                                                                                                                                                                                                          | F                      | 445                | 105                                             | 91                                   | 8.9                                     | 8.2     | 20         | Juvenile (74 days)         | Wang <i>et al.</i> (2018a)                                                 |
| Bivalvia | <i>Lampsilis siliquoidea</i> | Freshwater mussel | EC <sub>20</sub> | Biomass                       | 672           | LT                    | P/S                                                                                                                                                                                                                          | F                      | 437                | 105                                             | 91                                   | 8.9                                     | 8.2     | 20         | Juvenile (74 days)         | Wang <i>et al.</i> (2018a)                                                 |
| Bivalvia | <i>Lampsilis siliquoidea</i> | Freshwater mussel | EC <sub>20</sub> | Dry weight                    | 672           | LT                    | P/S                                                                                                                                                                                                                          | F                      | 227                | 105                                             | 91                                   | 8.9                                     | 8.2     | 20         | Juvenile (74 days)         | Wang <i>et al.</i> (2018a)                                                 |
| Bivalvia | <i>Lampsilis siliquoidea</i> | Freshwater mussel | EC <sub>20</sub> | Biomass                       | 672           | LT                    | P/S                                                                                                                                                                                                                          | F                      | 264                | 105                                             | 91                                   | 8.9                                     | 8.2     | 20         | Juvenile (74 days)         | Wang <i>et al.</i> (2018a)                                                 |
| Bivalvia | <i>Lampsilis siliquoidea</i> | Freshwater mussel | EC <sub>20</sub> | Length, dry weight, biomass   | 672           | LT                    | P/S                                                                                                                                                                                                                          | F                      | > 676              | 103                                             | 93                                   | 8.0                                     | 8.1     | 23         | Juvenile (65 days)         | Wang <i>et al.</i> (2018a)                                                 |
| Bivalvia | <i>Lampsilis siliquoidea</i> | Freshwater mussel | EC <sub>20</sub> | Length, dry weight, biomass   | 1344          | LT                    | P/S                                                                                                                                                                                                                          | F                      | > 659              | 103                                             | 95                                   | 7.8                                     | 8.1     | 23         | Juvenile (65 days)         | Wang <i>et al.</i> (2018a)                                                 |
| Bivalvia | <i>Lampsilis siliquoidea</i> | Freshwater mussel | EC <sub>20</sub> | Length                        | 2016          | LT                    | P/S                                                                                                                                                                                                                          | F                      | 628                | 104                                             | 96                                   | 7.8                                     | 8       | 23         | Juvenile (65 days)         | Wang <i>et al.</i> (2018a)                                                 |
| Bivalvia | <i>Lampsilis siliquoidea</i> | Freshwater mussel | EC <sub>20</sub> | Dry weight                    | 2016          | LT                    | P/S                                                                                                                                                                                                                          | F                      | 527                | 104                                             | 96                                   | 7.8                                     | 8       | 23         | Juvenile (65 days)         | Wang <i>et al.</i> (2018a)                                                 |
| Bivalvia | <i>Lampsilis siliquoidea</i> | Freshwater mussel | EC <sub>20</sub> | Biomass                       | 2016          | LT                    | P/S                                                                                                                                                                                                                          | F                      | 482                | 104                                             | 96                                   | 7.8                                     | 8       | 23         | Juvenile (65 days)         | Wang <i>et al.</i> (2018a)                                                 |
| Bivalvia | <i>Lampsilis siliquoidea</i> | Freshwater mussel | EC <sub>20</sub> | Length                        | 672           | LT                    | P/S                                                                                                                                                                                                                          | F                      | 656                | 98                                              | 97                                   | 7.8                                     | 8.1     | 23         | Juvenile (30 days)         | Wang <i>et al.</i> (2018a)                                                 |
| Bivalvia | <i>Lampsilis siliquoidea</i> | Freshwater mussel | EC <sub>20</sub> | Dry weight                    | 672           | LT                    | P/S                                                                                                                                                                                                                          | F                      | 425                | 98                                              | 97                                   | 7.8                                     | 8.1     | 23         | Juvenile (30 days)         | Wang <i>et al.</i> (2018a)                                                 |

Table A-1. LONG-TERM/ CHRONIC DATA - NaCl, KCl, CaCl<sub>2</sub>, and MgCl<sub>2</sub> SALTS

| Class    | Species                      | Common name       | Endpoint         | Endpoint criteria             | Exp. time (h) | LT (SSD) <sup>A</sup> | Data quality <sup>B</sup>                                    | Exp. type <sup>C</sup> | Chloride (mg Cl/L) | Hardness <sup>D</sup> (mg CaCO <sub>3</sub> /L) | Alkalinity (mg CaCO <sub>3</sub> /L) | Dissolved oxygen (mg O <sub>2</sub> /L) | pH      | Temp. (°C) | Life stage characteristics | Citation                                                            |
|----------|------------------------------|-------------------|------------------|-------------------------------|---------------|-----------------------|--------------------------------------------------------------|------------------------|--------------------|-------------------------------------------------|--------------------------------------|-----------------------------------------|---------|------------|----------------------------|---------------------------------------------------------------------|
| Bivalvia | <i>Lampsilis siliquoidea</i> | Freshwater mussel | EC <sub>20</sub> | Biomass                       | 672           | LT                    | P/S                                                          | F                      | 403                | 98                                              | 97                                   | 7.8                                     | 8.1     | 23         | Juvenile (30 days)         | Wang et al. (2018a)                                                 |
| Bivalvia | <i>Lampsilis siliquoidea</i> | Freshwater mussel | EC <sub>20</sub> | Length                        | 672           | LT                    | P/S                                                          | F                      | 358                | 105                                             | 97                                   | 7.9                                     | 8.1     | 23         | Juvenile (10 days)         | Wang et al. (2018a)                                                 |
| Bivalvia | <i>Lampsilis siliquoidea</i> | Freshwater mussel | EC <sub>20</sub> | Dry weight                    | 672           | LT                    | P/S                                                          | F                      | 244                | 105                                             | 97                                   | 7.9                                     | 8.1     | 23         | Juvenile (10 days)         | Wang et al. (2018a)                                                 |
| Bivalvia | <i>Lampsilis siliquoidea</i> | Freshwater mussel | EC <sub>20</sub> | Biomass                       | 672           | LT                    | P/S                                                          | F                      | 251                | 105                                             | 97                                   | 7.9                                     | 8.1     | 23         | Juvenile (10 days)         | Wang et al. (2018a)                                                 |
| Bivalvia | <i>Lampsilis siliquoidea</i> | Freshwater mussel | EC <sub>20</sub> | Length                        | 2016          | LT                    | P/S                                                          | F                      | 323                | 103                                             | 96                                   | 7.8                                     | 8.0     | 23         | Juvenile (10 days)         | Wang et al. (2018a)                                                 |
| Bivalvia | <i>Lampsilis siliquoidea</i> | Freshwater mussel | EC <sub>20</sub> | Dry weight                    | 2016          | LT                    | P/S                                                          | F                      | 173                | 103                                             | 96                                   | 7.8                                     | 8.0     | 23         | Juvenile (10 days)         | Wang et al. (2018a)                                                 |
| Bivalvia | <i>Lampsilis siliquoidea</i> | Freshwater mussel | EC <sub>20</sub> | Biomass                       | 2016          | LT                    | P/S                                                          | F                      | 158                | 103                                             | 96                                   | 7.8                                     | 8.0     | 23         | Juvenile (10 days)         | Wang et al. (2018a)                                                 |
| Bivalvia | <i>Lampsilis siliquoidea</i> | Freshwater mussel | EC <sub>10</sub> | Glochidia functional survival | 24            | LT                    | P/S                                                          | S                      | 730                | 42                                              | 41                                   | 8.9                                     | 7.4     | 20.4       | Glochidia                  | UGARF (2016a)                                                       |
| Bivalvia | <i>Lampsilis siliquoidea</i> | Freshwater mussel | EC <sub>10</sub> | Glochidia functional survival | 24            | LT                    | P/S                                                          | S                      | 681                | 82                                              | 80                                   | 9.29                                    | 7.91    | 20.2       | Glochidia                  | UGARF (2016a)                                                       |
| Bivalvia | <i>Lampsilis siliquoidea</i> | Freshwater mussel | EC <sub>10</sub> | Glochidia functional survival | 24            | LT                    | P/S                                                          | S                      | 2877               | 168                                             | 162                                  | 9.29                                    | 8.48    | 20.1       | Glochidia                  | UGARF (2016a)                                                       |
| Bivalvia | <i>Lampsilis siliquoidea</i> | Freshwater mussel | EC <sub>10</sub> | Glochidia functional survival | 24            | LT                    | P/S                                                          | S                      | 1662               | 298                                             | 280                                  | 8.74                                    | 8.37    | 20.8       | Glochidia                  | UGARF (2016a)                                                       |
| Bivalvia | <i>Lampsilis siliquoidea</i> | Freshwater mussel | EC <sub>10</sub> | Glochidia functional survival | 25            | LT                    | U                                                            | S                      | 565                | 464                                             | 384                                  | 8.9                                     | 8.3     | 20.6       | Glochidia                  | UGARF (2016a)                                                       |
| Bivalvia | <i>Musculium securis</i>     | Fingernail clam   | LOEC             | Reproduction                  | 1440-1920     | LT                    | P/S                                                          | N/S                    | 121                | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Mackie (1978)                                                       |
| Bivalvia | <i>Villosa constricta</i>    | Freshwater mussel | EC <sub>10</sub> | Survival                      | 24            | LT                    | P/S                                                          | S                      | 789                | 169                                             | 116-130                              | >80 % sat                               | 8.3-8.6 | 20.1-21.9  | Glochidia                  | Bringolf et al. (2010); CCME (2011) calculation from available data |
| Bivalvia | <i>Villosa constricta</i>    | Freshwater mussel | EC <sub>10</sub> | Survival                      | 48            | LT                    | U (as per CCME (2011), only < 24h glochidia exposures valid) | S                      | 267                | 169                                             | 116-130                              | >80 % sat                               | 8.3-8.6 | 20.1-21.9  | Glochidia                  | Bringolf et al. (2010)                                              |
| Bivalvia | <i>Villosa delumbis</i>      | Freshwater mussel | EC <sub>10</sub> | Survival                      | 24            | LT                    | P/S                                                          | S                      | 716                | 169                                             | 116-130                              | >80 % sat                               | 8.3-8.6 | 20.1-21.9  | Glochidia                  | Bringolf et al. (2010); CCME (2011) calculation from available data |
| Bivalvia | <i>Villosa delumbis</i>      | Freshwater mussel | EC <sub>10</sub> | Survival                      | 48            | LT                    | U (as per CCME (2011), only < 24h glochidia exposures valid) | S                      | 825                | 169                                             | 116-130                              | >80 % sat                               | 8.3-8.6 | 20.1-21.9  | Glochidia                  | Bringolf et al. (2010)                                              |





Table A-1. LONG-TERM/ CHRONIC DATA - NaCl, KCl, CaCl<sub>2</sub>, and MgCl<sub>2</sub> SALTS

| Class        | Species                   | Common name | Endpoint         | Endpoint criteria         | Exp. time (h) | LT (SSD) <sup>A</sup> | Data quality <sup>B</sup> | Exp. type <sup>C</sup> | Chloride (mg Cl/L) | Hardness <sup>D</sup> (mg CaCO <sub>3</sub> /L) | Alkalinity (mg CaCO <sub>3</sub> /L) | Dissolved oxygen (mg O <sub>2</sub> /L) | pH      | Temp. (°C) | Life stage characteristics | Citation                      |
|--------------|---------------------------|-------------|------------------|---------------------------|---------------|-----------------------|---------------------------|------------------------|--------------------|-------------------------------------------------|--------------------------------------|-----------------------------------------|---------|------------|----------------------------|-------------------------------|
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>50</sub> | Reproduction              | 168           | LT                    | P/S                       | SR                     | 370                | 44                                              | N/S                                  | N/S                                     | 7.2-7.6 | N/S        | 6-30 h old                 | Aragao & Pereira (2003)       |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>50</sub> | Reproduction              | 168           | LT                    | P/S                       | SR                     | 455                | 44                                              | N/S                                  | N/S                                     | 7.2-7.6 | N/S        | 6-30 h old                 | Aragao & Pereira (2003)       |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>50</sub> | Reproduction              | 168           | LT                    | P/S                       | SR                     | 582                | 44                                              | N/S                                  | N/S                                     | 7.2-7.6 | N/S        | 6-30 h old                 | Aragao & Pereira (2003)       |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>50</sub> | Reproduction              | 168           | LT                    | P/S                       | SR                     | 431                | 44                                              | N/S                                  | N/S                                     | 7.2-7.6 | N/S        | 6-30 h old                 | Aragao & Pereira (2003)       |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>50</sub> | Reproduction              | 168           | LT                    | P/S                       | SR                     | 412                | 44                                              | N/S                                  | N/S                                     | 7.2-7.6 | N/S        | 6-30 h old                 | Aragao & Pereira (2003)       |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>50</sub> | Reproduction              | 168           | LT                    | P/S                       | SR                     | 437                | 44                                              | N/S                                  | N/S                                     | 7.2-7.6 | N/S        | 6-30 h old                 | Aragao & Pereira (2003)       |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | NOEC             | Mortality                 | 168           | Chronic               | P/S                       | SR                     | 406                | 170                                             | 110-120                              | N/S                                     | 7.0-8.5 | 24-26      | 0-24 h old                 | Cooney <i>et al.</i> (1992)   |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | LOEC             | Mortality                 | 168           | Chronic               | P/S                       | SR                     | 1456               | 170                                             | 110-120                              | N/S                                     | 7.0-8.5 | 24-26      | 0-24 h old                 | Cooney <i>et al.</i> (1992)   |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | MATC             | Mortality                 | 168           | Chronic               | P/S                       | SR                     | 1261               | 170                                             | 110-120                              | N/S                                     | 7.0-8.5 | 24-26      | 0-24 h old                 | Cooney <i>et al.</i> (1992)   |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | NOEC             | Reproduction (Brood size) | 168           | LT                    | P/S                       | SR                     | 637                | 170                                             | 110-120                              | N/S                                     | 7.0-8.5 | 24-26      | 0-24 h old                 | Cooney <i>et al.</i> (1992)   |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | LOEC             | Reproduction (Brood size) | 168           | LT                    | P/S                       | SR                     | 774                | 170                                             | 110-120                              | N/S                                     | 7.0-8.5 | 24-26      | 0-24 h old                 | Cooney <i>et al.</i> (1992)   |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | EC <sub>50</sub> | Reproduction              | 216           | LT                    | P/S                       | S                      | 1068               | 100                                             | N/S                                  | >6.5                                    | 8.0-8.4 | 23-27      | N/S                        | Cowgill & Milazzo (1990)      |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | EC <sub>50</sub> | Reproduction              | 216           | LT                    | P/S                       | S                      | 1088               | 100                                             | N/S                                  | >6.5                                    | 8.0-8.4 | 23-27      | N/S                        | Cowgill & Milazzo (1990)      |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | EC <sub>50</sub> | Reproduction              | 216           | LT                    | P/S                       | S                      | 1208               | 100                                             | N/S                                  | >6.5                                    | 8.0-8.4 | 23-27      | N/S                        | Cowgill & Milazzo (1990)      |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | NOEC             | Reproduction              | 216           | LT                    | P/S                       | S                      | 786                | 100                                             | N/S                                  | >6.5                                    | 8.0-8.4 | 23-27      | N/S                        | Cowgill & Milazzo (1990)      |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | NOEC             | Reproduction              | 216           | LT                    | P/S                       | S                      | 786                | 100                                             | N/S                                  | >6.5                                    | 8.0-8.4 | 23-27      | N/S                        | Cowgill & Milazzo (1990)      |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | NOEC             | Reproduction              | 216           | LT                    | P/S                       | S                      | 786                | 100                                             | N/S                                  | >6.5                                    | 8.0-8.4 | 23-27      | N/S                        | Cowgill & Milazzo (1990)      |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | LC <sub>50</sub> | Mortality                 | 168           | Chronic               | P/S                       | S                      | 1088               | 100                                             | N/S                                  | >6.5                                    | 8.0-8.4 | 23-27      | <24 h old                  | Cowgill & Milazzo (1990)      |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>50</sub> | Reproduction (brood size) | 168           | LT                    | P/S                       | SR                     | 813                | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Degraeve <i>et al.</i> (1992) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>50</sub> | Reproduction (brood size) | 168           | LT                    | P/S                       | SR                     | 582                | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Degraeve <i>et al.</i> (1992) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | LC <sub>50</sub> | Mortality                 | 168           | Chronic               | P/S                       | SR                     | 1074               | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Degraeve <i>et al.</i> (1992) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | LC <sub>50</sub> | Mortality                 | 168           | Chronic               | P/S                       | SR                     | 807                | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Degraeve <i>et al.</i> (1992) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>50</sub> | Reproduction (brood size) | 168           | LT                    | P/S                       | SR                     | 394                | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Degraeve <i>et al.</i> (1992) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>50</sub> | Reproduction (brood size) | 168           | LT                    | P/S                       | SR                     | 437                | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Degraeve <i>et al.</i> (1992) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>50</sub> | Reproduction (brood size) | 168           | LT                    | P/S                       | SR                     | 443                | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Degraeve <i>et al.</i> (1992) |

Table A-1. LONG-TERM/ CHRONIC DATA - NaCl, KCl, CaCl<sub>2</sub>, and MgCl<sub>2</sub> SALTS

| Class        | Species                   | Common name | Endpoint         | Endpoint criteria         | Exp. time (h) | LT (SSD) <sup>A</sup> | Data quality <sup>B</sup> | Exp. type <sup>C</sup> | Chloride (mg Cl/L) | Hardness <sup>D</sup> (mg CaCO <sub>3</sub> /L) | Alkalinity (mg CaCO <sub>3</sub> /L) | Dissolved oxygen (mg O <sub>2</sub> /L) | pH      | Temp. (°C) | Life stage characteristics | Citation               |
|--------------|---------------------------|-------------|------------------|---------------------------|---------------|-----------------------|---------------------------|------------------------|--------------------|-------------------------------------------------|--------------------------------------|-----------------------------------------|---------|------------|----------------------------|------------------------|
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>50</sub> | Reproduction (brood size) | 168           | LT                    | P/S                       | SR                     | 449                | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Degraeve et al. (1992) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>50</sub> | Reproduction (brood size) | 168           | LT                    | P/S                       | SR                     | 182                | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Degraeve et al. (1992) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>50</sub> | Reproduction (brood size) | 168           | LT                    | P/S                       | SR                     | 843                | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Degraeve et al. (1992) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>50</sub> | Reproduction (brood size) | 168           | LT                    | P/S                       | SR                     | 783                | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Degraeve et al. (1992) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>50</sub> | Reproduction (brood size) | 168           | LT                    | P/S                       | SR                     | 813                | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Degraeve et al. (1992) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>50</sub> | Reproduction (brood size) | 168           | LT                    | P/S                       | SR                     | 916                | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Degraeve et al. (1992) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>50</sub> | Reproduction (brood size) | 168           | LT                    | P/S                       | SR                     | 971                | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Degraeve et al. (1992) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>50</sub> | Reproduction (brood size) | 168           | LT                    | P/S                       | SR                     | 1025               | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Degraeve et al. (1992) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>50</sub> | Reproduction (brood size) | 168           | LT                    | P/S                       | SR                     | 1068               | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Degraeve et al. (1992) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>50</sub> | Reproduction (brood size) | 168           | LT                    | P/S                       | SR                     | 1153               | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Degraeve et al. (1992) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | LC <sub>50</sub> | Mortality                 | 168           | Chronic               | P/S                       | SR                     | 910                | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Degraeve et al. (1992) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | LC <sub>50</sub> | Mortality                 | 168           | Chronic               | P/S                       | SR                     | 170                | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Degraeve et al. (1992) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | LC <sub>50</sub> | Mortality                 | 168           | Chronic               | P/S                       | SR                     | 552                | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Degraeve et al. (1992) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | LC <sub>50</sub> | Mortality                 | 168           | Chronic               | P/S                       | SR                     | 710                | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Degraeve et al. (1992) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | LC <sub>50</sub> | Mortality                 | 168           | Chronic               | P/S                       | SR                     | 867                | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Degraeve et al. (1992) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | LC <sub>50</sub> | Mortality                 | 168           | Chronic               | P/S                       | SR                     | 995                | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Degraeve et al. (1992) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | LC <sub>50</sub> | Mortality                 | 168           | Chronic               | P/S                       | SR                     | 1037               | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Degraeve et al. (1992) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | LC <sub>50</sub> | Mortality                 | 168           | Chronic               | P/S                       | SR                     | 1055               | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Degraeve et al. (1992) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | NOEC             | Mortality                 | 168           | Chronic               | P/S                       | S                      | 182                | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | <24 h old                  | Diamond et al. (1992)  |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | LOEC             | Mortality                 | 168           | Chronic               | P/S                       | S                      | 455                | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | <24 h old                  | Diamond et al. (1992)  |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | MATC             | Mortality                 | 168           | Chronic               | P/S                       | S                      | 288                | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | <24 h old                  | Diamond et al. (1992)  |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | NOEC             | Reproduction              | 168           | LT                    | P/S                       | S                      | 121                | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | <24 h old                  | Diamond et al. (1992)  |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | LOEC             | Reproduction              | 168           | LT                    | P/S                       | S                      | 455                | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | <24 h old                  | Diamond et al. (1992)  |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | MATC             | Reproduction              | 168           | LT                    | P/S                       | S                      | 235                | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | <24 h old                  | Diamond et al. (1992)  |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>50</sub> | Reproduction              | 168           | LT                    | P/S                       | SR                     | 697                | 85                                              | 60                                   | N/S                                     | 7.4-7.8 | 25         | <24 h old                  | Elphick et al. (2011a) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>25</sub> | Reproduction              | 168           | LT                    | P/S                       | SR                     | 117                | 10                                              | N/S                                  | N/S                                     | 7.4-7.8 | 25         | <24 h old                  | Elphick et al. (2011a) |

Table A-1. LONG-TERM/ CHRONIC DATA - NaCl, KCl, CaCl<sub>2</sub>, and MgCl<sub>2</sub> SALTS

| Class        | Species                   | Common name | Endpoint         | Endpoint criteria        | Exp. time (h) | LT (SSD) <sup>A</sup> | Data quality <sup>B</sup> | Exp. type <sup>C</sup> | Chloride (mg Cl/L) | Hardness <sup>D</sup> (mg CaCO <sub>3</sub> /L) | Alkalinity (mg CaCO <sub>3</sub> /L) | Dissolved oxygen (mg O <sub>2</sub> /L) | pH      | Temp. (°C) | Life stage characteristics | Citation               |
|--------------|---------------------------|-------------|------------------|--------------------------|---------------|-----------------------|---------------------------|------------------------|--------------------|-------------------------------------------------|--------------------------------------|-----------------------------------------|---------|------------|----------------------------|------------------------|
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>25</sub> | Reproduction             | 168           | LT                    | P/S                       | SR                     | 264                | 20                                              | N/S                                  | N/S                                     | 7.4-7.8 | 25         | <24 h old                  | Elphick et al. (2011a) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>25</sub> | Reproduction             | 168           | LT                    | P/S                       | SR                     | 146                | 40                                              | N/S                                  | N/S                                     | 7.4-7.8 | 25         | <24 h old                  | Elphick et al. (2011a) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>25</sub> | Reproduction             | 168           | LT                    | P/S                       | SR                     | 454                | 80                                              | 57-64                                | N/S                                     | 7.4-7.8 | 25         | <24 h old                  | Elphick et al. (2011a) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>25</sub> | Reproduction             | 168           | LT                    | P/S                       | SR                     | 580                | 160                                             | N/S                                  | N/S                                     | 7.4-7.8 | 25         | <24 h old                  | Elphick et al. (2011a) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>25</sub> | Reproduction             | 168           | LT                    | P/S                       | SR                     | 521                | 320                                             | N/S                                  | N/S                                     | 7.4-7.8 | 25         | <24 h old                  | Elphick et al. (2011a) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>50</sub> | Reproduction             | 168           | LT                    | P/S                       | SR                     | 161                | 10                                              | N/S                                  | N/S                                     | 7.4-7.8 | 25         | <24 h old                  | Elphick et al. (2011a) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>50</sub> | Reproduction             | 168           | LT                    | P/S                       | SR                     | 301                | 20                                              | N/S                                  | N/S                                     | 7.4-7.8 | 25         | <24 h old                  | Elphick et al. (2011a) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>50</sub> | Reproduction             | 168           | LT                    | P/S                       | SR                     | 481                | 40                                              | N/S                                  | N/S                                     | 7.4-7.8 | 25         | <24 h old                  | Elphick et al. (2011a) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>50</sub> | Reproduction             | 168           | LT                    | P/S                       | SR                     | 697                | 80                                              | 57-64                                | N/S                                     | 7.4-7.8 | 25         | <24 h old                  | Elphick et al. (2011a) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>50</sub> | Reproduction             | 168           | LT                    | P/S                       | SR                     | 895                | 160                                             | N/S                                  | N/S                                     | 7.4-7.8 | 25         | <24 h old                  | Elphick et al. (2011a) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>50</sub> | Reproduction             | 168           | LT                    | P/S                       | SR                     | 700                | 320                                             | N/S                                  | N/S                                     | 7.4-7.8 | 25         | <24 h old                  | Elphick et al. (2011a) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | LC <sub>50</sub> | Survival                 | 168           | Chronic               | P/S                       | SR                     | 132                | 10                                              | N/S                                  | N/S                                     | 7.4-7.8 | 25         | <24 h old                  | Elphick et al. (2011a) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | LC <sub>50</sub> | Survival                 | 168           | Chronic               | P/S                       | SR                     | 316                | 20                                              | N/S                                  | N/S                                     | 7.4-7.8 | 25         | <24 h old                  | Elphick et al. (2011a) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | LC <sub>50</sub> | Survival                 | 168           | Chronic               | P/S                       | SR                     | 540                | 40                                              | N/S                                  | N/S                                     | 7.4-7.8 | 25         | <24 h old                  | Elphick et al. (2011a) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | LC <sub>50</sub> | Survival                 | 168           | Chronic               | P/S                       | SR                     | 1134               | 80                                              | N/S                                  | N/S                                     | 7.4-7.8 | 25         | <24 h old                  | Elphick et al. (2011a) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | LC <sub>50</sub> | Survival                 | 168           | Chronic               | P/S                       | SR                     | 1240               | 160                                             | N/S                                  | N/S                                     | 7.4-7.8 | 25         | <24 h old                  | Elphick et al. (2011a) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | LC <sub>50</sub> | Survival                 | 168           | Chronic               | P/S                       | SR                     | 1303               | 320                                             | N/S                                  | N/S                                     | 7.4-7.8 | 25         | <24 h old                  | Elphick et al. (2011a) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | NOEC             | Reproduction             | 168           | LT                    | P/S                       | SR                     | 267                | 65                                              | 56-62                                | 8.36                                    | 7.6-8.3 | 23-27      | <24 h old                  | Harmon et al. (2003)   |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | LOEC             | Reproduction             | 168           | LT                    | P/S                       | SR                     | 516                | 65                                              | 56-62                                | 8.36                                    | 7.6-8.3 | 23-27      | <24 h old                  | Harmon et al. (2003)   |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | EC50             | Mortality & Reproduction | 168           | Chronic               | P/S                       | SR                     | 819                | 63                                              | 56-76                                | 8.36                                    | 7.6-8.3 | 23-27      | <24 h old                  | Harmon et al. (2003)   |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | NOEC             | Mortality                | 168           | Chronic               | P/S                       | SR                     | 1031               | 63                                              | 56-76                                | 8.36                                    | 7.6-8.3 | 23-27      | <24 h old                  | Harmon et al. (2003)   |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | LOEC             | Mortality                | 168           | Chronic               | P/S                       | SR                     | 1335               | 63                                              | 56-76                                | 8.36                                    | 7.6-8.3 | 23-27      | <24 h old                  | Harmon et al. (2003)   |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>50</sub> | Reproduction             | 144-168       | LT                    | P/S                       | S                      | 342                | 39                                              | 45                                   | >80 % sat                               | 8-8.7   | 25         | <24 h old                  | Lasier & Harden (2010) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>25</sub> | Reproduction             | 144-168       | LT                    | P/S                       | S                      | 147                | 39                                              | 45                                   | >80 % sat                               | 8-8.7   | 25         | <24 h old                  | Lasier & Harden (2010) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>50</sub> | Reproduction             | 144-168       | LT                    | P/S                       | S                      | 653                | 85                                              | 66                                   | >80 % sat                               | 8-8.7   | 25         | <24 h old                  | Lasier & Harden (2010) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>25</sub> | Reproduction             | 144-168       | LT                    | P/S                       | S                      | 456                | 85                                              | 66                                   | >80 % sat                               | 8-8.7   | 25         | <24 h old                  | Lasier & Harden (2010) |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>50</sub> | Reproduction             | 144-168       | LT                    | P/S                       | S                      | 563                | 39                                              | 101                                  | >80 % sat                               | 8-8.7   | 25         | <24 h old                  | Lasier & Harden (2010) |

Table A-1. LONG-TERM/ CHRONIC DATA - NaCl, KCl, CaCl<sub>2</sub>, and MgCl<sub>2</sub> SALTS

| Class        | Species                   | Common name | Endpoint         | Endpoint criteria                        | Exp. time (h) | LT (SSD) <sup>A</sup> | Data quality <sup>B</sup> | Exp. type <sup>C</sup> | Chloride (mg Cl/L) | Hardness <sup>D</sup> (mg CaCO <sub>3</sub> /L) | Alkalinity (mg CaCO <sub>3</sub> /L) | Dissolved oxygen (mg O <sub>2</sub> /L) | pH        | Temp. (°C) | Life stage characteristics | Citation                                                                 |
|--------------|---------------------------|-------------|------------------|------------------------------------------|---------------|-----------------------|---------------------------|------------------------|--------------------|-------------------------------------------------|--------------------------------------|-----------------------------------------|-----------|------------|----------------------------|--------------------------------------------------------------------------|
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>25</sub> | Reproduction                             | 144-168       | LT                    | P/S                       | S                      | 340                | 39                                              | 101                                  | >80 % sat                               | 8-8.7     | 25         | <24 h old                  | Lasier & Harden (2010)                                                   |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | EC <sub>13</sub> | Reproduction                             | 168           | LT                    | P/S                       | SR                     | 342                | 100                                             | 69                                   | N/S                                     | 8         | 25         | <24 h old                  | Lasier <i>et al.</i> (2006)                                              |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | EC <sub>22</sub> | Reproduction                             | 168           | LT                    | P/S                       | SR                     | 342                | 45                                              | 99                                   | N/S                                     | 8         | 25         | <24 h old                  | Lasier <i>et al.</i> (2006)                                              |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | EC <sub>35</sub> | Reproduction                             | 168           | LT                    | P/S                       | SR                     | 342                | 46                                              | 44                                   | N/S                                     | 8         | 25         | <24 h old                  | Lasier <i>et al.</i> (2006)                                              |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | EC <sub>17</sub> | Reproduction                             | 168           | LT                    | P/S                       | SR                     | 342                | 99                                              | 96                                   | N/S                                     | 8         | 25         | <24 h old                  | Lasier <i>et al.</i> (2006)                                              |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | EC <sub>33</sub> | Reproduction                             | 168           | LT                    | P/S                       | SR                     | 565                | 100                                             | 69                                   | N/S                                     | 8         | 25         | <24 h old                  | Lasier <i>et al.</i> (2006)                                              |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | EC <sub>54</sub> | Reproduction                             | 168           | LT                    | P/S                       | SR                     | 565                | 45                                              | 99                                   | N/S                                     | 8         | 25         | <24 h old                  | Lasier <i>et al.</i> (2006)                                              |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | EC <sub>59</sub> | Reproduction                             | 168           | LT                    | P/S                       | SR                     | 565                | 46                                              | 44                                   | N/S                                     | 8         | 25         | <24 h old                  | Lasier <i>et al.</i> (2006)                                              |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | EC <sub>44</sub> | Reproduction                             | 168           | LT                    | P/S                       | SR                     | 565                | 99                                              | 96                                   | N/S                                     | 8         | 25         | <24 h old                  | Lasier <i>et al.</i> (2006)                                              |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | LC <sub>50</sub> | Mortality                                | 168           | LT                    | P/S                       | SR                     | 963                | 90                                              | 80                                   | >4.0 mg/L                               | 7.4-8.24  | 24-27      | <24 h old                  | Struewing <i>et al.</i> (2015)                                           |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>25</sub> | Reproduction                             | 168           | LT                    | P/S                       | SR                     | 600                | 90                                              | 80                                   | >4.0 mg/L                               | 7.4-8.24  | 24-27      | <24 h old                  | Struewing <i>et al.</i> (2015)                                           |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>10</sub> | Reproduction                             | 144           | LT                    | P/S                       | SR                     | 80                 | 11                                              | 10                                   | 7.97-8.92                               | 7.12-8.52 | 24-26      | <24 h old                  | WSLH (2016)                                                              |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>10</sub> | Reproduction                             | 168           | LT                    | P/S                       | SR                     | 236                | 44                                              | 30                                   | 8.12-9.43                               | 8.68-8.87 | 24-26      | <24 h old                  | WSLH (2016)                                                              |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>10</sub> | Reproduction                             | 168           | LT                    | P/S                       | SR                     | 279                | 89                                              | 59                                   | N/S                                     | 7.4-7.8   | 24-26      | <24 h old                  | WSLH (2016)                                                              |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>10</sub> | Reproduction                             | 168           | LT                    | P/S                       | SR                     | 492                | 173                                             | 114                                  | N/S                                     | 7.6-8.0   | 24-26      | <24 h old                  | WSLH (2016)                                                              |
| Branchiopoda | <i>Ceriodaphnia dubia</i> | Water flea  | IC <sub>10</sub> | Reproduction                             | 168           | LT                    | P/S                       | SR                     | 540                | 350                                             | 224                                  | 8.06-9.27                               | 8.24-8.86 | 24-26      | <24 h old                  | WSLH (2016)                                                              |
| Branchiopoda | <i>Daphnia ambigua</i>    | Water flea  | NOEC             | Imobilization                            | 240           | Chronic               | P/S                       | SR                     | 267                | 63                                              | 56-76                                | 8.36                                    | 7.6-8.3   | 19-23      | <24 h old                  | Harmon <i>et al.</i> (2003)                                              |
| Branchiopoda | <i>Daphnia ambigua</i>    | Water flea  | LOEC             | Imobilization                            | 240           | Chronic               | P/S                       | SR                     | 516                | 63                                              | 56-76                                | 8.36                                    | 7.6-8.3   | 19-23      | <24 h old                  | Harmon <i>et al.</i> (2003)                                              |
| Branchiopoda | <i>Daphnia ambigua</i>    | Water flea  | MATC             | Imobilization                            | 240           | Chronic               | P/S                       | SR                     | 371                | 63                                              | 56-76                                | 8.36                                    | 7.6-8.3   | 19-23      | <24 h old                  | Harmon <i>et al.</i> (2003)                                              |
| Branchiopoda | <i>Daphnia ambigua</i>    | Water flea  | EC <sub>10</sub> | Mortality & Reproduction                 | 240           | LT                    | P/S                       | SR                     | 259                | 63                                              | 56-76                                | 8.3                                     | 8.1-8.7   | 19-23      | <24 h old                  | Harmon <i>et al.</i> (2003); CCME (2011) calculation from available data |
| Branchiopoda | <i>Daphnia ambigua</i>    | Water flea  | EC <sub>50</sub> | Mortality & Reproduction                 | 240           | LT                    | P/S                       | SR                     | 394                | 63                                              | 56-76                                | 8.3                                     | 8.1-8.7   | 19-23      | <24 h old                  | Harmon <i>et al.</i> (2003)                                              |
| Branchiopoda | <i>Daphnia ambigua</i>    | Water flea  | NOEC             | Reproduction (mean # offspring / female) | 240           | LT                    | P/S                       | SR                     | 267                | 63                                              | 56-76                                | 8.36                                    | 7.6-8.3   | 19-23      | <24 h old                  | Harmon <i>et al.</i> (2003)                                              |
| Branchiopoda | <i>Daphnia ambigua</i>    | Water flea  | LOEC             | Reproduction (mean # offspring / female) | 240           | LT                    | P/S                       | SR                     | 516                | 63                                              | 56-76                                | 8.36                                    | 7.6-8.3   | 19-23      | <24 h old                  | Harmon <i>et al.</i> (2003)                                              |

Table A-1. LONG-TERM/ CHRONIC DATA - NaCl, KCl, CaCl<sub>2</sub>, and MgCl<sub>2</sub> SALTS

| Class        | Species                | Common name | Endpoint         | Endpoint criteria                    | Exp. time (h) | LT (SSD) <sup>A</sup> | Data quality <sup>B</sup> | Exp. type <sup>C</sup> | Chloride (mg Cl/L) | Hardness <sup>D</sup> (mg CaCO <sub>3</sub> /L) | Alkalinity (mg CaCO <sub>3</sub> /L) | Dissolved oxygen (mg O <sub>2</sub> /L) | pH       | Temp. (°C) | Life stage characteristics | Citation                                                       |
|--------------|------------------------|-------------|------------------|--------------------------------------|---------------|-----------------------|---------------------------|------------------------|--------------------|-------------------------------------------------|--------------------------------------|-----------------------------------------|----------|------------|----------------------------|----------------------------------------------------------------|
| Branchiopoda | <i>Daphnia catawba</i> | Water flea  | EC <sub>10</sub> | Mortality                            | 504           | LT                    | P/S                       | SR                     | 89                 | 9.41                                            | N/S                                  | > 8.0                                   | 6.4      | 20         | < 24 hr                    | Amott <i>et al.</i> (2020) EEI calculation from available data |
| Branchiopoda | <i>Daphnia magna</i>   | Water flea  | LC <sub>50</sub> | Mortality                            | 504           | Chronic               | P/S                       | SR                     | 2282               | 45                                              | 42                                   | 9                                       | 7.4-8.2  | 17-19      | 12-24 h old                | Biesinger & Christensen (1972)                                 |
| Branchiopoda | <i>Daphnia magna</i>   | Water flea  | IC <sub>50</sub> | Reproduction                         | 504           | LT                    | P/S                       | SR                     | 1573               | 45                                              | 42                                   | 9                                       | 7.4-8.2  | 17-19      | 12-24 h old                | Biesinger & Christensen (1972)                                 |
| Branchiopoda | <i>Daphnia magna</i>   | Water flea  | IC <sub>16</sub> | Reproduction                         | 504           | LT                    | P/S                       | SR                     | 1049               | 45                                              | 42                                   | 9                                       | 7.4-8.2  | 17-19      | 12-24 h old                | Biesinger & Christensen (1972)                                 |
| Branchiopoda | <i>Daphnia magna</i>   | Water flea  | LC <sub>50</sub> | Mortality                            | 168           | Chronic               | P/S                       | S                      | 3504               | 170                                             | N/S                                  | > 8.1                                   | 7.9-8.2  | 23-27      | N/S                        | Cowgill & Milazzo (1990)                                       |
| Branchiopoda | <i>Daphnia magna</i>   | Water flea  | NOEC             | Reproduction (mean brood size)       | 240           | LT                    | P/S                       | S                      | 786                | 170                                             | N/S                                  | > 8.1                                   | 7.9-8.2  | 23-27      | N/S                        | Cowgill & Milazzo (1990)                                       |
| Branchiopoda | <i>Daphnia magna</i>   | Water flea  | NOEC             | Reproduction (mean # of broods)      | 240           | LT                    | P/S                       | S                      | 786                | 170                                             | N/S                                  | > 8.1                                   | 7.9-8.2  | 23-27      | N/S                        | Cowgill & Milazzo (1990)                                       |
| Branchiopoda | <i>Daphnia magna</i>   | Water flea  | NOEC             | Reproduction (Total progeny)         | 240           | LT                    | P/S                       | S                      | 2184               | 170                                             | N/S                                  | > 8.1                                   | 7.9-8.2  | 23-27      | N/S                        | Cowgill & Milazzo (1990)                                       |
| Branchiopoda | <i>Daphnia magna</i>   | Water flea  | NOEC             | Growth (dry weight)                  | 240           | LT                    | P/S                       | S                      | 786                | 170                                             | N/S                                  | > 8.1                                   | 7.9-8.2  | 23-27      | N/S                        | Cowgill & Milazzo (1990)                                       |
| Branchiopoda | <i>Daphnia magna</i>   | Water flea  | EC <sub>50</sub> | Reproduction (mean brood size)       | 240           | LT                    | P/S                       | S                      | 2451               | 170                                             | N/S                                  | > 8.1                                   | 7.9-8.2  | 23-27      | N/S                        | Cowgill & Milazzo (1990)                                       |
| Branchiopoda | <i>Daphnia magna</i>   | Water flea  | EC <sub>50</sub> | Reproduction (Total progeny)         | 240           | LT                    | P/S                       | S                      | 2597               | 170                                             | N/S                                  | > 8.1                                   | 7.9-8.2  | 23-27      | N/S                        | Cowgill & Milazzo (1990)                                       |
| Branchiopoda | <i>Daphnia magna</i>   | Water flea  | EC <sub>50</sub> | Growth (dry weight)                  | 240           | LT                    | P/S                       | S                      | 2614               | 170                                             | N/S                                  | > 8.1                                   | 7.9-8.2  | 23-27      | N/S                        | Cowgill & Milazzo (1990)                                       |
| Branchiopoda | <i>Daphnia magna</i>   | Water flea  | EC <sub>50</sub> | Reproduction (mean number of broods) | 240           | LT                    | P/S                       | S                      | 3504               | 170                                             | N/S                                  | > 8.1                                   | 7.9-8.2  | 23-27      | N/S                        | Cowgill & Milazzo (1990)                                       |
| Branchiopoda | <i>Daphnia magna</i>   | Water flea  | IC <sub>25</sub> | Reproduction                         | 504           | LT                    | P/S                       | SR                     | 421                | 85                                              | 60                                   | N/S                                     | 7.4-7.8  | 20         | < 24 h old                 | Elphick <i>et al.</i> (2011a)                                  |
| Branchiopoda | <i>Daphnia magna</i>   | Water flea  | IC <sub>50</sub> | Reproduction                         | 504           | LT                    | P/S                       | SR                     | 1037               | 85                                              | 60                                   | N/S                                     | 7.4-7.8  | 20         | < 24 h old                 | Elphick <i>et al.</i> (2011a)                                  |
| Branchiopoda | <i>Daphnia magna</i>   | Water flea  | NOEC             | Reproduction                         | 504           | Chronic               | P/S                       | SR                     | < 506              | 85                                              | 60                                   | N/S                                     | 7.4-7.8  | 20         | < 24 h old                 | Elphick <i>et al.</i> (2011a)                                  |
| Branchiopoda | <i>Daphnia magna</i>   | Water flea  | LOEC             | Reproduction                         | 504           | LT                    | P/S                       | SR                     | 506                | 85                                              | 60                                   | N/S                                     | 7.4-7.8  | 20         | < 24 h old                 | Elphick <i>et al.</i> (2011a)                                  |
| Branchiopoda | <i>Daphnia magna</i>   | Water flea  | NOEC             | Mortality                            | 504           | LT                    | P/S                       | SR                     | 1980               | 90                                              | 60                                   | 7.6-8.8                                 | 7.4-8.1  | 19-21      | < 24 h old                 | Rescan (2007)                                                  |
| Branchiopoda | <i>Daphnia magna</i>   | Water flea  | LOEC             | Mortality                            | 504           | LT                    | P/S                       | SR                     | 4070               | 90                                              | 60                                   | 7.6-8.8                                 | 7.4-8.1  | 19-21      | < 24 h old                 | Rescan (2007)                                                  |
| Branchiopoda | <i>Daphnia magna</i>   | Water flea  | LC <sub>50</sub> | Mortality                            | 504           | Chronic               | P/S                       | SR                     | 2311               | 90                                              | 60                                   | 7.6-8.8                                 | 7.4-8.1  | 19-21      | < 24 h old                 | Rescan (2007)                                                  |
| Branchiopoda | <i>Daphnia magna</i>   | Water flea  | LC <sub>50</sub> | Mortality                            | 96            | Chronic               | P/S                       | SR                     | 2616               | 90                                              | 80                                   | > 4.0 mg/L                              | 7.4-8.24 | 24-27      | < 24 h old                 | Struwing <i>et al.</i> (2015)                                  |
| Branchiopoda | <i>Daphnia magna</i>   | Water flea  | IC <sub>25</sub> | Biomass                              | 96            | Chronic               | P/S                       | SR                     | 1667               | 90                                              | 80                                   | > 4.0 mg/L                              | 7.4-8.24 | 24-27      | < 24 h old                 | Struwing <i>et al.</i> (2015)                                  |

Table A-1. LONG-TERM/ CHRONIC DATA - NaCl, KCl, CaCl<sub>2</sub>, and MgCl<sub>2</sub> SALTS

| Class         | Species                                                  | Common name | Endpoint           | Endpoint criteria                    | Exp. time (h) | LT (SSD) <sup>A</sup> | Data quality <sup>B</sup> | Exp. type <sup>C</sup> | Chloride (mg Cl/L) | Hardness <sup>D</sup> (mg CaCO <sub>3</sub> /L) | Alkalinity (mg CaCO <sub>3</sub> /L) | Dissolved oxygen (mg O <sub>2</sub> /L) | pH   | Temp. (°C) | Life stage characteristics | Citation                                                                                  |
|---------------|----------------------------------------------------------|-------------|--------------------|--------------------------------------|---------------|-----------------------|---------------------------|------------------------|--------------------|-------------------------------------------------|--------------------------------------|-----------------------------------------|------|------------|----------------------------|-------------------------------------------------------------------------------------------|
| Branchiopoda  | <i>Daphnia mendotae</i>                                  | Water flea  | EC <sub>10</sub>   | Mortality                            | 504           | LT                    | P/S                       | SR                     | 107                | 9.41                                            | N/S                                  | > 8.0                                   | 6.4  | 20         | <24 hr                     | Amott <i>et al.</i> (2020) EEI calculation from available data                            |
| Branchiopoda  | <i>Daphnia minnehaha</i>                                 | Water flea  | EC <sub>10</sub>   | Mortality                            | 504           | LT                    | P/S                       | SR                     | 60                 | 9.41                                            | N/S                                  | > 8.0                                   | 6.4  | 20         | <24 hr                     | Amott <i>et al.</i> (2020) EEI calculation from available data                            |
| Branchiopoda  | <i>Daphnia pulex</i>                                     | Water flea  | EC <sub>10</sub>   | Mortality                            | 504           | LT                    | P/S                       | SR                     | >145.46            | 9.41                                            | N/S                                  | > 8.0                                   | 6.4  | 20         | <24 hr                     | Amott <i>et al.</i> (2020) EEI calculation from available data                            |
| Branchiopoda  | <i>Daphnia pulex</i>                                     | Water flea  | NOEC               | Reproduction, mortality, growth      | 504           | LT                    | P/S                       | SR                     | 314                | 96                                              | 48-69                                | 8.8                                     | 7.94 | 20         | Juvenile                   | Birge <i>et al.</i> (1985)                                                                |
| Branchiopoda  | <i>Daphnia pulex</i>                                     | Water flea  | LOEC               | Reproduction, mortality, growth      | 504           | LT                    | P/S                       | SR                     | 441                | 96                                              | 48-69                                | 8.8                                     | 7.94 | 20         | Juvenile                   | Birge <i>et al.</i> (1985)                                                                |
| Branchiopoda  | <i>Daphnia pulex</i>                                     | Water flea  | MATC               | Reproduction, mortality, growth      | 504           | LT                    | P/S                       | SR                     | 372                | 96                                              | 48-69                                | 8.8                                     | 7.94 | 20         | Juvenile                   | Birge <i>et al.</i> (1985)                                                                |
| Branchiopoda  | <i>Daphnia pulex</i>                                     | Water flea  | IC <sub>10</sub>   | Reproduction                         | 504           | LT                    | P/S                       | SR                     | 368                | 97                                              | 48-69                                | 8.8                                     | 7.94 | 20         | Juvenile                   | Birge <i>et al.</i> (1985); Elphick <i>et al.</i> (2011a) calculation from available data |
| Branchiopoda  | <i>Daphnia pulicaria</i>                                 | Water flea  | EC <sub>10</sub>   | Mortality                            | 504           | LT                    | P/S                       | SR                     | 210                | 9.41                                            | N/S                                  | > 8.0                                   | 6.4  | 20         | < 24 hr                    | Amott <i>et al.</i> (2020) EEI calculation from available data                            |
| Branchiopoda  | hybrid <i>Daphnia pulicaria</i> and <i>Daphnia pulex</i> | Water flea  | EC <sub>10</sub>   | Mortality                            | 504           | LT                    | P/S                       | SR                     | 226                | 9.41                                            | N/S                                  | > 8.0                                   | 6.4  | 20         | < 24 hr                    | Amott <i>et al.</i> (2020) EEI calculation from available data                            |
| Chlorophyceae | <i>Chlamydomonas reinhardtii</i>                         | Green algae | EC <sub>50</sub>   | Population Growth                    | 96            | LT                    | P/S                       | S                      | 2875               | N/S                                             | N/S                                  | N/S                                     | N/S  | 22-24      | Adult                      | Moser & Bell (2011)                                                                       |
| Chlorophyceae | <i>Chlamydomonas reinhardtii</i>                         | Green algae | EC <sub>50</sub>   | Population Growth                    | 96            | LT                    | P/S                       | S                      | 3445               | N/S                                             | N/S                                  | N/S                                     | N/S  | 22-24      | Adult                      | Moser & Bell (2011)                                                                       |
| Chlorophyceae | <i>Chlamydomonas reinhardtii</i>                         | Green algae | EC <sub>50</sub>   | Population Growth                    | 144           | LT                    | P/S                       | S                      | 3013               | N/S                                             | N/S                                  | N/S                                     | N/S  | 25         | N/S                        | Reynoso & Gamboa (1982)                                                                   |
| Chlorophyceae | <i>Dictyosphaerium chloroellodes</i>                     | Green algae | EC <sub>50</sub>   | Population Growth                    | 72            | LT                    | U (sea salt used)         | s                      | 12079              | N/S                                             | N/S                                  | N/S                                     | N/S  | 23         | Adult                      | Bartolome <i>et al.</i> (2009)                                                            |
| Chlorophyceae | <i>Dictyosphaerium chloroellodes</i>                     | Green algae | EC <sub>50</sub>   | Physiology (Photosynthesis)          | 72            | LT                    | U (sea salt used)         | s                      | 12685              | N/S                                             | N/S                                  | N/S                                     | N/S  | 22         | Adult                      | Bartolome <i>et al.</i> (2009)                                                            |
| Chlorophyceae | <i>Scenedesmus obliquus</i>                              | Green algae | See footnotes E(2) | Population Growth                    | 168           | LT                    | ?                         | ?                      | 7091               | N/S                                             | N/S                                  | N/S                                     | N/S  | 24-26      | N/S                        | Mohammed & Shafea (1999)                                                                  |
| Chlorophyceae | <i>Scenedesmus obliquus</i>                              | Green algae | See footnotes E(3) | Physiological                        | 168           | LT                    | ?                         | ?                      | 4255               | N/S                                             | N/S                                  | N/S                                     | N/S  | 24-26      | N/S                        | Mohammed & Shafea (1999)                                                                  |
| Chlorophyceae | <i>Pseudokirchneriella subcapitata</i>                   | Green algae | EC <sub>50</sub>   | Population florescence               | 96            | LT                    | P/S                       | N/S                    | 674                | 15                                              | N/S                                  | N/S                                     | N/S  | N/S        | N/S                        | Simmons (2012)                                                                            |
| Chlorophyceae | <i>Pseudokirchneriella subcapitata</i>                   | Green algae | EC <sub>50</sub>   | Population growth (log cell density) | 96            | LT                    | P/S                       | N/S                    | 780                | 15                                              | N/S                                  | N/S                                     | N/S  | N/S        | N/S                        | Simmons (2012)                                                                            |

Table A-1. LONG-TERM/ CHRONIC DATA - NaCl, KCl, CaCl<sub>2</sub>, and MgCl<sub>2</sub> SALTS

| Class         | Species                                | Common name          | Endpoint         | Endpoint criteria                    | Exp. time (h) | LT (SSD) <sup>A</sup> | Data quality <sup>B</sup>          | Exp. type <sup>C</sup> | Chloride (mg Cl/L) | Hardness <sup>D</sup> (mg CaCO <sub>3</sub> /L) | Alkalinity (mg CaCO <sub>3</sub> /L) | Dissolved oxygen (mg O <sub>2</sub> /L) | pH        | Temp. (°C) | Life stage characteristics | Citation                      |
|---------------|----------------------------------------|----------------------|------------------|--------------------------------------|---------------|-----------------------|------------------------------------|------------------------|--------------------|-------------------------------------------------|--------------------------------------|-----------------------------------------|-----------|------------|----------------------------|-------------------------------|
| Chlorophyceae | <i>Pseudokirchneriella subcapitata</i> | Green algae          | EC <sub>10</sub> | Population growth (log cell density) | 96            | LT                    | P/S                                | N/S                    | 124                | 15                                              | N/S                                  | N/S                                     | N/S       | N/S        | N/S                        | Simmons (2012)                |
| Chlorophyceae | <i>Pseudokirchneriella subcapitata</i> | Green algae          | EC <sub>10</sub> | Population fluorescence              | 96            | LT                    | P/S                                | N/S                    | 96                 | 15                                              | N/S                                  | N/S                                     | N/S       | N/S        | N/S                        | Simmons (2012)                |
| Chlorophyceae | <i>Pseudokirchneriella subcapitata</i> | Green algae          | IC <sub>50</sub> | Cell density                         | 72            | LT                    | P/S                                | N/S                    | 523                | N/S                                             | N/S                                  | N/S                                     | N/S       | 25         | N/S                        | Santos <i>et al.</i> (2007)   |
| Chlorophyceae | <i>Pseudokirchneriella subcapitata</i> | Green algae          | IC <sub>50</sub> | Population fluorescence              | 96            | LT                    | P/S                                | N/S                    | 1213               | 170 (160-180)                                   | N/S                                  | N/S                                     | N/S       | N/S        | N/S                        | Geis <i>et al.</i> (2000)     |
| Chlorophyceae | <i>Pseudokirchneriella subcapitata</i> | Green algae          | IC <sub>50</sub> | Population fluorescence              | 96            | LT                    | P/S                                | N/S                    | 1820               | 170 (160-180)                                   | N/S                                  | N/S                                     | N/S       | N/S        | N/S                        | Geis <i>et al.</i> (2000)     |
| Chlorophyceae | <i>Pseudokirchneriella subcapitata</i> | Green algae          | IC <sub>50</sub> | Population fluorescence              | 96            | LT                    | P/S                                | N/S                    | 2149               | 85                                              | N/S                                  | N/S                                     | N/S       | 22.7       | N/S                        | Geis & Hemming (2014)         |
| Chlorophyceae | <i>Pseudokirchneriella subcapitata</i> | Green algae          | IC <sub>50</sub> | Population fluorescence              | 96            | LT                    | P/S                                | N/S                    | 1986               | 170                                             | N/S                                  | N/S                                     | N/S       | 22.7       | N/S                        | Geis & Hemming (2014)         |
| Chlorophyceae | <i>Pseudokirchneriella subcapitata</i> | Green algae          | IC <sub>10</sub> | Population fluorescence              | 96            | LT                    | P/S                                | N/S                    | 1270               | 85                                              | N/S                                  | N/S                                     | N/S       | 22.7       | N/S                        | Geis & Hemming (2014)         |
| Chlorophyceae | <i>Pseudokirchneriella subcapitata</i> | Green algae          | IC <sub>10</sub> | Population fluorescence              | 96            | LT                    | P/S                                | N/S                    | 955                | 170                                             | N/S                                  | N/S                                     | N/S       | 22.7       | N/S                        | Geis & Hemming (2014)         |
| Chlorophyceae | <i>Pseudokirchneriella subcapitata</i> | Green algae          | IC <sub>10</sub> | Growth (cell density)                | 96            | LT                    | P/S                                | S                      | 756                | 11                                              | 18                                   | 8.45-8.74                               | 7.17-7.26 | 24-26      | 4-7 days                   | WSLH (2016)                   |
| Chlorophyceae | <i>Pseudokirchneriella subcapitata</i> | Green algae          | IC <sub>10</sub> | Growth (cell density)                | 96            | LT                    | P/S                                | S                      | 1139               | 44                                              | 38                                   | 8.45-8.77                               | 7.76-7.92 | 24-26      | 4-7 days                   | WSLH (2016)                   |
| Chlorophyceae | <i>Pseudokirchneriella subcapitata</i> | Green algae          | IC <sub>10</sub> | Growth (cell density)                | 96            | LT                    | P/S                                | S                      | 1052               | 89                                              | 66                                   | 8.25-8.46                               | 7.83-8.23 | 24-26      | 4-7 days                   | WSLH (2016)                   |
| Chlorophyceae | <i>Pseudokirchneriella subcapitata</i> | Green algae          | IC <sub>10</sub> | Growth (cell density)                | 96            | LT                    | P/S                                | S                      | 1460               | 173                                             | 121                                  | 8.36-8.50                               | 8.32-8.46 | 24-26      | 4-7 days                   | WSLH (2016)                   |
| Chlorophyceae | <i>Pseudokirchneriella subcapitata</i> | Green algae          | IC <sub>10</sub> | Growth (cell density)                | 96            | LT                    | P/S                                | S                      | 1338               | 350                                             | 231                                  | 8.61-8.79                               | 8.60-8.75 | 24-26      | 4-7 days                   | WSLH (2016)                   |
| Chlorophyceae | <i>Pseudokirchneriella subcapitata</i> | Green algae          | IC <sub>10</sub> | Growth (cell density)                | 97            | LT                    | P/S                                | S                      | 1529               | 576                                             | 336                                  | 8.51-8.96                               | 8.29-8.48 | 24-26      | 4-7 days                   | WSLH (2016)                   |
| Citellata     | <i>Limnodrilus hoffmeisteri</i>        | Tubificid worm       | LC <sub>50</sub> | Mortality                            | 261           | Chronic               | U (no mention of control survival) | S                      | 3518               | 100                                             | N/S                                  | N/S                                     | N/S       | N/S        | N/S                        | Wurtz & Bridges (1961)        |
| Citellata     | <i>Lumbriculus variegatus</i>          | California blackworm | IC <sub>25</sub> | Biomass                              | 672           | LT                    | P/S                                | SR                     | 825                | 85                                              | 60                                   | N/S                                     | 7.4-7.8   | 23         | Adult                      | Elphick <i>et al.</i> (2011a) |
| Citellata     | <i>Lumbriculus variegatus</i>          | California blackworm | IC <sub>50</sub> | Biomass                              | 672           | LT                    | P/S                                | SR                     | 1366               | 85                                              | 60                                   | N/S                                     | 7.4-7.8   | 23         | Adult                      | Elphick <i>et al.</i> (2011a) |
| Citellata     | <i>Lumbriculus variegatus</i>          | California blackworm | NOEC             | Biomass                              | 672           | Chronic               | P/S                                | SR                     | <366               | 85                                              | 60                                   | N/S                                     | 7.4-7.8   | 23         | Adult                      | Elphick <i>et al.</i> (2011a) |
| Citellata     | <i>Lumbriculus variegatus</i>          | California blackworm | LOEC             | Biomass                              | 672           | LT                    | P/S                                | SR                     | 366                | 85                                              | 60                                   | N/S                                     | 7.4-7.8   | 23         | Adult                      | Elphick <i>et al.</i> (2011a) |
| Citellata     | <i>Tubifex tubifex</i>                 | Tubificid worm       | IC <sub>10</sub> | Reproduction                         | 672           | LT                    | P/S                                | SR                     | 519                | 85                                              | 60                                   | N/S                                     | 7.4-7.8   | 23         | Adult                      | Elphick <i>et al.</i> (2011a) |
| Citellata     | <i>Tubifex tubifex</i>                 | Tubificid worm       | IC <sub>25</sub> | Reproduction                         | 672           | LT                    | P/S                                | SR                     | 606                | 85                                              | 60                                   | N/S                                     | 7.4-7.8   | 23         | Adult                      | Elphick <i>et al.</i> (2011a) |
| Citellata     | <i>Tubifex tubifex</i>                 | Tubificid worm       | IC <sub>50</sub> | Reproduction                         | 672           | LT                    | P/S                                | SR                     | 752                | 85                                              | 60                                   | N/S                                     | 7.4-7.8   | 23         | Adult                      | Elphick <i>et al.</i> (2011a) |

Table A-1. LONG-TERM/ CHRONIC DATA - NaCl, KCl, CaCl<sub>2</sub>, and MgCl<sub>2</sub> SALTS

| Class        | Species                        | Common name    | Endpoint         | Endpoint criteria                       | Exp. time (h) | LT (SSD) <sup>A</sup> | Data quality <sup>B</sup> | Exp. type <sup>C</sup> | Chloride (mg Cl/L) | Hardness <sup>D</sup> (mg CaCO <sub>3</sub> /L) | Alkalinity (mg CaCO <sub>3</sub> /L) | Dissolved oxygen (mg O <sub>2</sub> /L) | pH      | Temp. (°C) | Life stage characteristics | Citation                 |
|--------------|--------------------------------|----------------|------------------|-----------------------------------------|---------------|-----------------------|---------------------------|------------------------|--------------------|-------------------------------------------------|--------------------------------------|-----------------------------------------|---------|------------|----------------------------|--------------------------|
| Clitellata   | <i>Tubifex tubifex</i>         | Tubificid worm | NOEC             | Reproduction                            | 672           | LT                    | P/S                       | SR                     | 462                | 85                                              | 60                                   | N/S                                     | 7.4-7.8 | 23         | Adult                      | Elphick et al. (2011a)   |
| Clitellata   | <i>Tubifex tubifex</i>         | Tubificid worm | LOEC             | Reproduction                            | 672           | LT                    | P/S                       | SR                     | 964                | 85                                              | 60                                   | N/S                                     | 7.4-7.8 | 23         | Adult                      | Elphick et al. (2011a)   |
| Clitellata   | <i>Tubifex tubifex</i>         | Tubificid worm | EC <sub>25</sub> | Physiological (Cocoon formation)        | 672           | LT                    | P/S                       | SR                     | 620                | 90                                              | 60                                   | 5.5-8.5                                 | 7.2-7.8 | 22-24      | Adult                      | Rescan (2007)            |
| Clitellata   | <i>Tubifex tubifex</i>         | Tubificid worm | EC <sub>50</sub> | Physiological (Cocoon formation)        | 672           | LT                    | P/S                       | SR                     | 809                | 90                                              | 60                                   | 5.5-8.5                                 | 7.2-7.8 | 22-24      | Adult                      | Rescan (2007)            |
| Clitellata   | <i>Tubifex tubifex</i>         | Tubificid worm | NOEC             | Physiological (Cocoon formation)        | 672           | LT                    | P/S                       | SR                     | 964                | 90                                              | 60                                   | 5.5-8.5                                 | 7.2-7.8 | 22-24      | Adult                      | Rescan (2007)            |
| Clitellata   | <i>Tubifex tubifex</i>         | Tubificid worm | LOEC             | Physiological (Cocoon formation)        | 672           | LT                    | P/S                       | SR                     | 2138               | 90                                              | 60                                   | 5.5-8.5                                 | 7.2-7.8 | 22-24      | Adult                      | Rescan (2007)            |
| Clitellata   | <i>Tubifex tubifex</i>         | Tubificid worm | NOEC             | Mortality                               | 672           | LT                    | P/S                       | SR                     | 2138               | 90                                              | 60                                   | 5.5-8.5                                 | 7.2-7.8 | 22-24      | Adult                      | Rescan (2007)            |
| Clitellata   | <i>Tubifex tubifex</i>         | Tubificid worm | LOEC             | Mortality                               | 672           | LT                    | P/S                       | SR                     | 4065               | 90                                              | 60                                   | 5.5-8.5                                 | 7.2-7.8 | 22-24      | Adult                      | Rescan (2007)            |
| Clitellata   | <i>Tubifex tubifex</i>         | Tubificid worm | EC <sub>25</sub> | Mortality                               | 672           | LT                    | P/S                       | SR                     | 2167               | 90                                              | 60                                   | 5.5-8.5                                 | 7.2-7.8 | 22-24      | Adult                      | Rescan (2007)            |
| Clitellata   | <i>Tubifex tubifex</i>         | Tubificid worm | EC <sub>50</sub> | Mortality                               | 672           | LT                    | P/S                       | SR                     | 3597               | 90                                              | 60                                   | 5.5-8.5                                 | 7.2-7.8 | 22-24      | Adult                      | Rescan (2007)            |
| Clitellata   | <i>Tubifex tubifex</i>         | Tubificid worm | EC <sub>50</sub> | Mortality                               | 672           | LT                    | P/S                       | SR                     | 4460               | 90                                              | 60                                   | 5.5-8.5                                 | 7.2-7.8 | 22-24      | Adult                      | Rescan (2007)            |
| Cyanophyceae | <i>Microcystis aeruginosa</i>  | Cyanobacteria  | EC <sub>50</sub> | Population Growth                       | 72            | LT                    | U (sea salt used)         | s                      | 2716               | N/S                                             | N/S                                  | N/S                                     | N/S     | 24         | Adult                      | Bartolome et al. (2009)  |
| Cyanophyceae | <i>Synechococcus elongatus</i> | Cyanobacteria  | EC <sub>50</sub> | Population growth                       | 96            | Chronic               | P/S                       | S                      | 12408              | 54                                              | N/S                                  | N/S                                     | N/S     | 30         | N/S                        | Bagchi et al. (2012)     |
| Cyanophyceae | <i>Anabaena doliolum</i>       | Cyanobacteria  | EC <sub>50</sub> | Population Growth                       | 288           | LT                    | U (not wild type)         | S                      | 4396               | N/S                                             | N/S                                  | N/S                                     | N/S     | 24         | Adult                      | Singh & Kshatriya (2002) |
| Cyanophyceae | <i>Anabaena doliolum</i>       | Cyanobacteria  | EC <sub>50</sub> | Population Growth                       | 288           | Chronic               | P/S                       | S                      | 1241               | N/S                                             | N/S                                  | N/S                                     | N/S     | 24         | Adult                      | Singh & Kshatriya (2002) |
| Cyanophyceae | <i>Anabaena doliolum</i>       | Cyanobacteria  | LC <sub>50</sub> | Mortality                               | 504           | Chronic               | P/S                       | N/S                    | 5318               | N/S                                             | N/S                                  | N/S                                     | 7.5     | 24         | Adult                      | Thapar et al. (2008)     |
| Cyanophyceae | <i>Anabaena variabilis</i>     | Cyanobacteria  | MATC             | Growth                                  | 96            | LT                    | ? (salt tolerant)         | N/S                    | 14300              | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | Adult                      | Schiewer (1984)          |
| Cyanophyceae | <i>Microcystis firma</i>       | Cyanobacteria  | LOEC             | Physiology                              | 24-240        | LT                    | ? (salt tolerant)         | N/S                    | 27297              | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | Adult                      | Schiewer (1984)          |
| Cyanophyceae | <i>Microcystis firma</i>       | Cyanobacteria  | LOEC             | Physiology                              | 24-240        | LT                    | ? (salt tolerant)         | N/S                    | 27297              | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | Adult                      | Schiewer (1984)          |
| Cyanophyceae | <i>Spirulina sp.</i>           | Cyanobacteria  | LOEC             | Population growth                       | 168           | LT                    | P/S (salt tolerant)       | S                      | 14181              | N/S                                             | N/S                                  | N/S                                     | 9       | 28         | Adult                      | Deniz et al. (2011)      |
| Cyanophyceae | <i>Spirulina sp.</i>           | Cyanobacteria  | LOEC             | Physiological (malondialdehyde content) | 168           | LT                    | P/S (salt tolerant)       | S                      | 19213              | N/S                                             | N/S                                  | N/S                                     | 9       | 28         | Adult                      | Deniz et al. (2011)      |
| Cyanophyceae | <i>Synechocystis aquatilis</i> | Cyanobacteria  | LOEC             | Physiology                              | 24-240        | LT                    | ? (salt tolerant)         | N/S                    | 8189               | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | Adult                      | Schiewer (1984)          |



**Table A-1. LONG-TERM/ CHRONIC DATA - NaCl, KCl, CaCl<sub>2</sub>, and MgCl<sub>2</sub> SALTS**

| Class        | Species                             | Common name   | Endpoint         | Endpoint criteria                            | Exp. time (h) | LT (SSD) <sup>A</sup> | Data quality <sup>B</sup>                  | Exp. type <sup>C</sup> | Chloride (mg Cl/L) | Hardness <sup>D</sup> (mg CaCO <sub>3</sub> /L) | Alkalinity (mg CaCO <sub>3</sub> /L) | Dissolved oxygen (mg O <sub>2</sub> /L) | pH      | Temp. (°C) | Life stage characteristics | Citation                                                   |
|--------------|-------------------------------------|---------------|------------------|----------------------------------------------|---------------|-----------------------|--------------------------------------------|------------------------|--------------------|-------------------------------------------------|--------------------------------------|-----------------------------------------|---------|------------|----------------------------|------------------------------------------------------------|
| Cyanophyceae | <i>Synechocystis aquatilis</i>      | Cyanobacteria | LOEC             | Physiology                                   | 24-240        | LT                    | ? (salt tolerant)                          | N/S                    | 8189               | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | Adult                      | Schiewer (1984)                                            |
| Cyanophyceae | <i>Synechocystis</i> sp.            | Cyanobacteria | EC <sub>50</sub> | Mortality                                    | 144           | LT                    | P/S                                        | N/S                    | 31907              | N/S                                             | N/S                                  | N/S                                     | N/S     | 25         | Adult                      | Ozturk & Asim (2010)                                       |
| Cyanophyceae | <i>Synechocystis</i> sp.            | Cyanobacteria | EC <sub>50</sub> | Mortality                                    | 144           | LT                    | P/S                                        | N/S                    | 67245              | N/S                                             | N/S                                  | N/S                                     | N/S     | 25         | Adult                      | Ozturk & Asim (2010)                                       |
| Cyanophyceae | <i>Synechocystis</i> sp.            | Cyanobacteria | EC <sub>50</sub> | Mortality                                    | 144           | LT                    | P/S                                        | N/S                    | 85424              | N/S                                             | N/S                                  | N/S                                     | N/S     | 25         | Adult                      | Ozturk & Asim (2010)                                       |
| Cyanophyceae | <i>Synechocystis</i> sp.            | Cyanobacteria | LOEC             | Physiological (Exopolysaccharide production) | 144           | LT                    | P/S                                        | N/S                    | 7820               | N/S                                             | N/S                                  | N/S                                     | N/S     | 25         | Adult                      | Ozturk & Asim (2010)                                       |
| Gastropoda   | <i>Physa</i>                        | Snail         | NOEC             | Mortality                                    | 1440          | LT                    | P/S                                        | S                      | 2000               | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Williamset al. (1999)                                      |
| Hydrozoa     | <i>Hydra attenuata</i>              | Hydra         | IC <sub>40</sub> | Avoidance (rounded/shortened tentacles)      | 96            | LT                    | U (Environmental conditions not specified) | S                      | 607                | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Castillo & Schafer (2000)                                  |
| Hydrozoa     | <i>Hydra attenuata</i>              | Hydra         | EC <sub>50</sub> | Morphological changes                        | 96            | Chronic               | P/S                                        | S                      | 874                | N/S                                             | N/S                                  | N/S                                     | 7.0-7.1 | 22         | N/S                        | Santos et al. (2007)                                       |
| Insecta      | Centropilum (Neocloeon) trianguifer | Mayfly        | EC <sub>10</sub> | Growth                                       | 480           | LT                    | U (River water used)                       | R                      | 328                | 134-1608                                        | 116 -152                             | 7.4 - 8.7                               | 6.8-8.8 | 22.1-26.8  | 5 days posthatch           | Johnson et al. (2015); EEI calculation from available data |
| Insecta      | Centropilum (Neocloeon) trianguifer | Mayfly        | EC <sub>10</sub> | Head width                                   | 480           | LT                    | U (River water used)                       | R                      | 341                | 134-1608                                        | 116 -152                             | 7.4 - 8.7                               | 6.8-8.8 | 22.1-26.8  | 5 days posthatch           | Johnson et al. (2015); EEI calculation from available data |
| Insecta      | Centropilum (Neocloeon) trianguifer | Mayfly        | LC <sub>20</sub> | Mortality                                    | 672           | LT                    | P/S                                        | SR                     | 361                | 42                                              | 54                                   | 6.2-9.0                                 | 6.5-8.3 | 23-25      | <48 hr old                 | Nautilus (2019)                                            |
| Insecta      | Centropilum (Neocloeon) trianguifer | Mayfly        | EC <sub>25</sub> | Emergence                                    | 672           | LT                    | P/S                                        | SR                     | 330                | 42                                              | 54                                   | 6.2-9.0                                 | 6.5-8.3 | 23-25      | <48 hr old                 | Nautilus (2019)                                            |
| Insecta      | Centropilum (Neocloeon) trianguifer | Mayfly        | IC <sub>25</sub> | Dry weight                                   | 672           | LT                    | P/S                                        | SR                     | >326               | 42                                              | 54                                   | 6.2-9.0                                 | 6.5-8.3 | 23-25      | <48 hr old                 | Nautilus (2019)                                            |
| Insecta      | Centropilum (Neocloeon) trianguifer | Mayfly        | LC <sub>20</sub> | Mortality                                    | 672           | LT                    | P/S                                        | SR                     | 243                | 84                                              | 85                                   | 6.4-9.9                                 | 8.1-8.4 | 23-25      | <48 hr old                 | Nautilus (2019)                                            |
| Insecta      | Centropilum (Neocloeon) trianguifer | Mayfly        | EC <sub>25</sub> | Emergence                                    | 672           | LT                    | P/S                                        | SR                     | 192                | 84                                              | 85                                   | 6.4-9.9                                 | 8.1-8.4 | 23-25      | <48 hr old                 | Nautilus (2019)                                            |
| Insecta      | Centropilum (Neocloeon) trianguifer | Mayfly        | IC <sub>25</sub> | Dry weight                                   | 672           | LT                    | P/S                                        | SR                     | >640               | 84                                              | 85                                   | 6.4-9.9                                 | 8.1-8.4 | 23-25      | <48 hr old                 | Nautilus (2019)                                            |
| Insecta      | Centropilum (Neocloeon) trianguifer | Mayfly        | LC <sub>20</sub> | Mortality                                    | 672           | LT                    | P/S                                        | SR                     | 373                | 168                                             | 135                                  | 6.2-8.8                                 | 8.0-8.6 | 23-25      | <48 hr old                 | Nautilus (2019)                                            |
| Insecta      | Centropilum (Neocloeon) trianguifer | Mayfly        | EC <sub>25</sub> | Emergence                                    | 672           | LT                    | P/S                                        | SR                     | 159                | 168                                             | 135                                  | 6.2-8.8                                 | 8.0-8.6 | 23-25      | <48 hr old                 | Nautilus (2019)                                            |

**Table A-1. LONG-TERM/ CHRONIC DATA - NaCl, KCl, CaCl<sub>2</sub>, and MgCl<sub>2</sub> SALTS**

| Class   | Species                                    | Common name | Endpoint         | Endpoint criteria                        | Exp. time (h) | LT (SSD) <sup>A</sup> | Data quality <sup>B</sup> | Exp. type <sup>C</sup> | Chloride (mg Cl/L) | Hardness <sup>D</sup> (mg CaCO <sub>3</sub> /L) | Alkalinity (mg CaCO <sub>3</sub> /L) | Dissolved oxygen (mg O <sub>2</sub> /L) | pH       | Temp. (°C) | Life stage characteristics | Citation                       |
|---------|--------------------------------------------|-------------|------------------|------------------------------------------|---------------|-----------------------|---------------------------|------------------------|--------------------|-------------------------------------------------|--------------------------------------|-----------------------------------------|----------|------------|----------------------------|--------------------------------|
| Insecta | Centropilum (Neocloeon) triangulifer       | Mayfly      | IC <sub>25</sub> | Dry weight                               | 672           | LT                    | P/S                       | SR                     | >642               | 168                                             | 135                                  | 6.2-8.8                                 | 8.0-8.6  | 23-25      | <48 hr old                 | Nautilus (2019)                |
| Insecta | Centropilum (Neocloeon) triangulifer       | Mayfly      | LC <sub>20</sub> | Mortality                                | 672           | LT                    | P/S                       | SR                     | 502                | 292                                             | 164                                  | 6.0-9.2                                 | 7.7-8.6  | 23-24      | <48 hr old                 | Nautilus (2019)                |
| Insecta | Centropilum (Neocloeon) triangulifer       | Mayfly      | EC <sub>25</sub> | Emergence                                | 672           | LT                    | P/S                       | SR                     | 146                | 292                                             | 164                                  | 6.0-9.2                                 | 7.7-8.6  | 23-24      | <48 hr old                 | Nautilus (2019)                |
| Insecta | Centropilum (Neocloeon) triangulifer       | Mayfly      | IC <sub>25</sub> | Dry weight                               | 672           | LT                    | P/S                       | SR                     | >344               | 292                                             | 164                                  | 6.0-9.2                                 | 7.7-8.6  | 23-24      | <48 hr old                 | Nautilus (2019)                |
| Insecta | Centropilum (Neocloeon) triangulifer       | Mayfly      | MATC             | Survival to pre-emergent stage           | 840           | LT                    | P/S                       | SR                     | 265                | 94                                              | 86                                   | 6.8-7.4                                 | 8.3      | 25.2       | <24 hr old                 | Souceck and Dickinson (2015)   |
| Insecta | Centropilum (Neocloeon) triangulifer       | Mayfly      | EC <sub>20</sub> | Survival to pre-emergent stage           | 840           | LT                    | P/S                       | SR                     | 190                | 94                                              | 86                                   | 6.8-7.5                                 | 8.3      | 25.2       | <24 hr old                 | Souceck and Dickinson (2015)   |
| Insecta | Centropilum (Neocloeon) triangulifer       | Mayfly      | MATC             | Pre-emergent nymph when control finished | 840           | LT                    | P/S                       | SR                     | 265                | 94                                              | 86                                   | 6.8-7.6                                 | 8.3      | 25.2       | <24 hr old                 | Souceck and Dickinson (2015)   |
| Insecta | Centropilum (Neocloeon) triangulifer       | Mayfly      | EC <sub>20</sub> | Pre-emergent nymph when control finished | 840           | LT                    | P/S                       | SR                     | 165                | 94                                              | 86                                   | 6.8-7.7                                 | 8.3      | 25.2       | <24 hr old                 | Souceck and Dickinson (2015)   |
| Insecta | Centropilum (Neocloeon) triangulifer       | Mayfly      | MATC             | Days to pre-emergent nymph stage         | 840           | LT                    | P/S                       | SR                     | 265                | 94                                              | 86                                   | 6.8-7.6                                 | 8.3      | 25.2       | <24 hr old                 | Souceck and Dickinson (2015)   |
| Insecta | Centropilum (Neocloeon) triangulifer       | Mayfly      | MATC             | Emergence                                | 840           | LT                    | P/S                       | SR                     | 504                | 94                                              | 86                                   | 6.8-7.7                                 | 8.3      | 25.2       | <24 hr old                 | Souceck and Dickinson (2015)   |
| Insecta | Centropilum (Neocloeon) triangulifer       | Mayfly      | LC <sub>50</sub> | Mortality                                | 336           | LT                    | P/S                       | SR                     | 505                | 90                                              | 80                                   | >4.0 mg/L                               | 7.4-8.24 | 24-27      | <24 h old                  | Struewing <i>et al.</i> (2015) |
| Insecta | Centropilum (Neocloeon) triangulifer       | Mayfly      | IC <sub>25</sub> | Biomass                                  | 336           | LT                    | P/S                       | SR                     | 139                | 90                                              | 80                                   | >4.0 mg/L                               | 7.4-8.24 | 24-27      | <24 h old                  | Struewing <i>et al.</i> (2015) |
| Insecta | <i>Chironomus dilutus</i> / <i>tentans</i> | Midge       | IC <sub>10</sub> | Biomass                                  | 480           | LT                    | P/S                       | SR                     | 2316               | 85                                              | 60                                   | N/S                                     | 7.4-7.8  | 23         | <24 h old                  | Elphick <i>et al.</i> (2011a)  |
| Insecta | <i>Chironomus dilutus</i> / <i>tentans</i> | Midge       | IC <sub>25</sub> | Biomass                                  | 480           | LT                    | P/S                       | SR                     | 2590               | 85                                              | 60                                   | N/S                                     | 7.4-7.8  | 23         | <24 h old                  | Elphick <i>et al.</i> (2011a)  |
| Insecta | <i>Chironomus dilutus</i> / <i>tentans</i> | Midge       | IC <sub>50</sub> | Biomass                                  | 480           | LT                    | P/S                       | SR                     | 3047               | 85                                              | 60                                   | N/S                                     | 7.4-7.8  | 23         | <24 h old                  | Elphick <i>et al.</i> (2011a)  |
| Insecta | <i>Chironomus dilutus</i> / <i>tentans</i> | Midge       | NOEC             | Biomass                                  | 480           | LT                    | P/S                       | SR                     | 2133               | 85                                              | 60                                   | N/S                                     | 7.4-7.8  | 23         | <24 h old                  | Elphick <i>et al.</i> (2011a)  |
| Insecta | <i>Chironomus dilutus</i> / <i>tentans</i> | Midge       | LOEC             | Biomass                                  | 480           | LT                    | P/S                       | SR                     | 3960               | 85                                              | 60                                   | N/S                                     | 7.4-7.8  | 23         | <24 h old                  | Elphick <i>et al.</i> (2011a)  |

Table A-1. LONG-TERM/ CHRONIC DATA - NaCl, KCl, CaCl<sub>2</sub>, and MgCl<sub>2</sub> SALTS

| Class   | Species                                    | Common name | Endpoint         | Endpoint criteria | Exp. time (h) | LT (SSD) <sup>A</sup> | Data quality <sup>B</sup> | Exp. type <sup>C</sup> | Chloride (mg Cl/L) | Hardness <sup>D</sup> (mg CaCO <sub>3</sub> /L) | Alkalinity (mg CaCO <sub>3</sub> /L) | Dissolved oxygen (mg O <sub>2</sub> /L) | pH      | Temp. (°C) | Life stage characteristics | Citation              |
|---------|--------------------------------------------|-------------|------------------|-------------------|---------------|-----------------------|---------------------------|------------------------|--------------------|-------------------------------------------------|--------------------------------------|-----------------------------------------|---------|------------|----------------------------|-----------------------|
| Insecta | <i>Chironomus dilutus</i> / <i>tentans</i> | Midge       | NOEC             | Mortality         | 480           | Chronic               | P/S                       | SR                     | 2133               | 90                                              | 60                                   | 5.8-8.0                                 | 7.6-8.1 | 22-24      | <24 h old                  | Rescan (2007)         |
| Insecta | <i>Chironomus dilutus</i> / <i>tentans</i> | Midge       | LOEC             | Mortality         | 480           | Chronic               | P/S                       | SR                     | 3960               | 90                                              | 60                                   | 5.8-8.0                                 | 7.6-8.1 | 22-24      | <24 h old                  | Rescan (2007)         |
| Insecta | <i>Chironomus dilutus</i> / <i>tentans</i> | Midge       | LC <sub>50</sub> | Mortality         | 480           | Chronic               | P/S                       | SR                     | 2812               | 90                                              | 60                                   | 5.8-8.0                                 | 7.6-8.1 | 22-24      | <24 h old                  | Rescan (2007)         |
| Insecta | <i>Hydropsyche betteni</i>                 | Caddisfly   | LC <sub>90</sub> | Mortality         | 240           | Chronic               | ?                         | ?                      | 5999               | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Kersey (1981)         |
| Insecta | <i>Stenonema modestum</i>                  | Mayfly      | NOEC             | Development       | 336           | LT                    | P/S                       | SR                     | 1213               | 49                                              | 35                                   | N/S                                     | 7.7     | 12         | Larva                      | Diamond et al. (1992) |
| Insecta | <i>Stenonema modestum</i>                  | Mayfly      | NOEC             | Development       | 336           | LT                    | P/S                       | SR                     | 2426               | 49                                              | 35                                   | N/S                                     | 7.7     | 12         | Larva                      | Diamond et al. (1992) |
| Insecta | <i>Stenonema modestum</i>                  | Mayfly      | LOEC             | Development       | 336           | LT                    | P/S                       | SR                     | 1638               | 49                                              | 35                                   | N/S                                     | 7.7     | 12         | Larva                      | Diamond et al. (1992) |
| Insecta | <i>Stenonema modestum</i>                  | Mayfly      | LOEC             | Development       | 336           | LT                    | P/S                       | SR                     | 3640               | 49                                              | 35                                   | N/S                                     | 7.7     | 12         | Larva                      | Diamond et al. (1992) |
| Insecta | <i>Stenonema modestum</i>                  | Mayfly      | NOEC             | Growth            | 336           | LT                    | P/S                       | SR                     | 1638               | 49                                              | 35                                   | N/S                                     | 7.7     | 12         | Larva                      | Diamond et al. (1992) |
| Insecta | <i>Stenonema modestum</i>                  | Mayfly      | NOEC             | Growth            | 336           | LT                    | P/S                       | SR                     | 2426               | 49                                              | 35                                   | N/S                                     | 7.7     | 12         | Larva                      | Diamond et al. (1992) |
| Insecta | <i>Stenonema modestum</i>                  | Mayfly      | LOEC             | Growth            | 336           | LT                    | P/S                       | SR                     | 2123               | 49                                              | 35                                   | N/S                                     | 7.7     | 12         | Larva                      | Diamond et al. (1992) |
| Insecta | <i>Stenonema modestum</i>                  | Mayfly      | LOEC             | Growth            | 336           | LT                    | P/S                       | SR                     | 4246               | 49                                              | 35                                   | N/S                                     | 7.7     | 12         | Larva                      | Diamond et al. (1992) |
| Insecta | <i>Stenonema modestum</i>                  | Mayfly      | NOEC             | Mortality         | 336           | Chronic               | P/S                       | SR                     | 1638               | 49                                              | 35                                   | N/S                                     | 7.7     | 12         | Larva                      | Diamond et al. (1992) |
| Insecta | <i>Stenonema modestum</i>                  | Mayfly      | NOEC             | Mortality         | 336           | Chronic               | P/S                       | SR                     | 3397               | 49                                              | 35                                   | N/S                                     | 7.7     | 12         | Larva                      | Diamond et al. (1992) |
| Insecta | <i>Stenonema modestum</i>                  | Mayfly      | LOEC             | Mortality         | 336           | Chronic               | P/S                       | SR                     | 4246               | 49                                              | 35                                   | N/S                                     | 7.7     | 12         | Larva                      | Diamond et al. (1992) |
| Insecta | <i>Stenonema modestum</i>                  | Mayfly      | LOEC             | Mortality         | 336           | Chronic               | P/S                       | SR                     | 2123               | 49                                              | 35                                   | N/S                                     | 7.7     | 12         | Larva                      | Diamond et al. (1992) |
| Insecta | <i>Stenonema modestum</i>                  | Mayfly      | NOEC             | Development       | 168           | LT                    | P/S                       | SR                     | 2426               | 49                                              | 35                                   | N/S                                     | 7.7     | 12         | Larva                      | Diamond et al. (1992) |
| Insecta | <i>Stenonema modestum</i>                  | Mayfly      | NOEC             | Development       | 168           | LT                    | P/S                       | SR                     | 2426               | 49                                              | 35                                   | N/S                                     | 7.7     | 12         | Larva                      | Diamond et al. (1992) |
| Insecta | <i>Stenonema modestum</i>                  | Mayfly      | LOEC             | Development       | 168           | LT                    | P/S                       | SR                     | 3640               | 49                                              | 35                                   | N/S                                     | 7.7     | 12         | Larva                      | Diamond et al. (1992) |
| Insecta | <i>Stenonema modestum</i>                  | Mayfly      | LOEC             | Development       | 168           | LT                    | P/S                       | SR                     | 4246               | 49                                              | 35                                   | N/S                                     | 7.7     | 12         | Larva                      | Diamond et al. (1992) |
| Insecta | <i>Stenonema modestum</i>                  | Mayfly      | LOEC             | Development       | 168           | LT                    | P/S                       | SR                     | 3088               | 49                                              | 35                                   | N/S                                     | 7.7     | 12         | Larva                      | Diamond et al. (1992) |
| Insecta | <i>Stenonema modestum</i>                  | Mayfly      | MATC             | Development       | 336           | LT                    | P/S                       | SR                     | 2047               | 49                                              | 35                                   | N/S                                     | 7.7     | 12         | Larva                      | Diamond et al. (1992) |
| Insecta | <i>Stenonema modestum</i>                  | Mayfly      | MATC             | Growth            | 336           | LT                    | P/S                       | SR                     | 2446               | 49                                              | 35                                   | N/S                                     | 7.7     | 12         | Larva                      | Diamond et al. (1992) |

Table A-1. LONG-TERM/ CHRONIC DATA - NaCl, KCl, CaCl<sub>2</sub>, and MgCl<sub>2</sub> SALTS

| Class                 | Species                   | Common name     | Endpoint         | Endpoint criteria                      | Exp. time (h) | LT (SSD) <sup>A</sup> | Data quality <sup>B</sup> | Exp. type <sup>C</sup> | Chloride (mg Cl/L) | Hardness <sup>D</sup> (mg CaCO <sub>3</sub> /L) | Alkalinity (mg CaCO <sub>3</sub> /L) | Dissolved oxygen (mg O <sub>2</sub> /L) | pH      | Temp. (°C) | Life stage characteristics | Citation                        |
|-----------------------|---------------------------|-----------------|------------------|----------------------------------------|---------------|-----------------------|---------------------------|------------------------|--------------------|-------------------------------------------------|--------------------------------------|-----------------------------------------|---------|------------|----------------------------|---------------------------------|
| Insecta               | <i>Stenonema modestum</i> | Mayfly          | MATC             | Mortality                              | 336           | Chronic               | P/S                       | SR                     | 2661               | 49                                              | 35                                   | N/S                                     | 7.7     | 12         | Larva                      | Diamond <i>et al.</i> (1992)    |
| Liliopsida (monocots) | <i>Lemna minor</i>        | Common duckweed | EC <sub>50</sub> | Growth Inhibition                      | 168           | LT                    | P/S                       | S                      | 3033               | 699                                             | N/S                                  | >90 % sat                               | 5       | 24         | Adult                      | Buckley <i>et al.</i> (1996)    |
| Liliopsida (monocots) | <i>Lemna minor</i>        | Common duckweed | EC <sub>50</sub> | Growth Inhibition                      | 168           | LT                    | P/S                       | S                      | 2960               | 699                                             | N/S                                  | >90 % sat                               | 5       | 24         | Adult                      | Buckley <i>et al.</i> (1996)    |
| Liliopsida (monocots) | <i>Lemna minor</i>        | Common duckweed | EC <sub>50</sub> | Growth Inhibition                      | 168           | LT                    | P/S                       | S                      | 3270               | 699                                             | N/S                                  | >90 % sat                               | 5       | 24         | Adult                      | Buckley <i>et al.</i> (1996)    |
| Liliopsida (monocots) | <i>Lemna minor</i>        | Common duckweed | EC <sub>50</sub> | Growth Inhibition                      | 168           | LT                    | P/S                       | S                      | 3336               | 699                                             | N/S                                  | >90 % sat                               | 5       | 24         | Adult                      | Buckley <i>et al.</i> (1996)    |
| Liliopsida (monocots) | <i>Lemna minor</i>        | Common duckweed | EC <sub>50</sub> | Growth                                 | 96            | LT                    | P/S                       | S                      | 4167               | N/S                                             | N/S                                  | N/S                                     | N/S     | 20         | Adult                      | Keppeler (2009)                 |
| Liliopsida (monocots) | <i>Lemna minor</i>        | Common duckweed | EC <sub>10</sub> | Growth (# live thalli)                 | 168           | LT                    | P/S                       | N/S                    | 496                | 140                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Simmons (2012)                  |
| Liliopsida (monocots) | <i>Lemna minor</i>        | Common duckweed | EC <sub>50</sub> | Growth (# live thalli)                 | 168           | LT                    | P/S                       | N/S                    | 1844               | 140                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Simmons (2012)                  |
| Liliopsida (monocots) | <i>Lemna minor</i>        | Common duckweed | MATC             | Physiology (chlorophyll concentration) | 96            | LT                    | P/S                       | SR                     | 813                | 39                                              | 2                                    | N/S                                     | 7.3-7.6 | 24.5-25.6  | Adult                      | Taraldsen & Norberg-King (1990) |
| Liliopsida (monocots) | <i>Lemna minor</i>        | Common duckweed | MATC             | Physiology (chlorophyll concentration) | 96            | LT                    | P/S                       | SR                     | 813                | 39                                              | 2                                    | N/S                                     | 7.3-7.6 | 24.5-25.6  | Adult                      | Taraldsen & Norberg-King (1990) |
| Liliopsida (monocots) | <i>Lemna minor</i>        | Common duckweed | MATC             | Physiology (chlorophyll concentration) | 96            | LT                    | P/S                       | SR                     | 1632               | 39                                              | 2                                    | N/S                                     | 7.3-7.6 | 24.5-25.6  | Adult                      | Taraldsen & Norberg-King (1990) |
| Liliopsida (monocots) | <i>Lemna minor</i>        | Common duckweed | MATC             | Physiology (chlorophyll concentration) | 96            | LT                    | P/S                       | SR                     | 1632               | 39                                              | 2                                    | N/S                                     | 7.3-7.6 | 24.5-25.6  | Adult                      | Taraldsen & Norberg-King (1990) |
| Liliopsida (monocots) | <i>Lemna minor</i>        | Common duckweed | MATC             | Physiology (chlorophyll concentration) | 96            | LT                    | P/S                       | SR                     | 855                | 39                                              | 2                                    | N/S                                     | 7.3-7.6 | 24.5-25.6  | Adult                      | Taraldsen & Norberg-King (1990) |
| Liliopsida (monocots) | <i>Lemna minor</i>        | Common duckweed | MATC             | Physiology (chlorophyll concentration) | 96            | LT                    | P/S                       | SR                     | 855                | 39                                              | 2                                    | N/S                                     | 7.3-7.6 | 24.5-25.6  | Adult                      | Taraldsen & Norberg-King (1990) |
| Liliopsida (monocots) | <i>Lemna minor</i>        | Common duckweed | MATC             | Growth (number of fronds)              | 96            | LT                    | P/S                       | SR                     | 813                | 39                                              | 2                                    | N/S                                     | 7.3-7.6 | 24.5-25.6  | Adult                      | Taraldsen & Norberg-King (1990) |
| Liliopsida (monocots) | <i>Lemna minor</i>        | Common duckweed | MATC             | Growth (number of fronds)              | 96            | LT                    | P/S                       | SR                     | 813                | 39                                              | 2                                    | N/S                                     | 7.3-7.6 | 24.5-25.6  | Adult                      | Taraldsen & Norberg-King (1990) |
| Liliopsida (monocots) | <i>Lemna minor</i>        | Common duckweed | MATC             | Growth (number of fronds)              | 96            | LT                    | P/S                       | SR                     | 1632               | 39                                              | 2                                    | N/S                                     | 7.3-7.6 | 24.5-25.6  | Adult                      | Taraldsen & Norberg-King (1990) |
| Liliopsida (monocots) | <i>Lemna minor</i>        | Common duckweed | MATC             | Growth (number of fronds)              | 96            | LT                    | P/S                       | SR                     | 1632               | 39                                              | 2                                    | N/S                                     | 7.3-7.6 | 24.5-25.6  | Adult                      | Taraldsen & Norberg-King (1990) |
| Liliopsida (monocots) | <i>Lemna minor</i>        | Common duckweed | MATC             | Growth (number of fronds)              | 96            | LT                    | P/S                       | SR                     | 1715               | 39                                              | 2                                    | N/S                                     | 7.3-7.6 | 24.5-25.6  | Adult                      | Taraldsen & Norberg-King (1990) |
| Liliopsida (monocots) | <i>Lemna minor</i>        | Common duckweed | MATC             | Growth (number of fronds)              | 96            | LT                    | P/S                       | SR                     | 855                | 39                                              | 2                                    | N/S                                     | 7.3-7.6 | 24.5-25.6  | Adult                      | Taraldsen & Norberg-King (1990) |

Table A-1. LONG-TERM/ CHRONIC DATA - NaCl, KCl, CaCl<sub>2</sub>, and MgCl<sub>2</sub> SALTS

| Class                 | Species                        | Common name           | Endpoint         | Endpoint criteria                                        | Exp. time (h) | LT (SSD) <sup>A</sup> | Data quality <sup>B</sup>          | Exp. type <sup>C</sup> | Chloride (mg Cl/L) | Hardness <sup>D</sup> (mg CaCO <sub>3</sub> /L) | Alkalinity (mg CaCO <sub>3</sub> /L) | Dissolved oxygen (mg O <sub>2</sub> /L) | pH      | Temp. (°C) | Life stage characteristics | Citation                      |
|-----------------------|--------------------------------|-----------------------|------------------|----------------------------------------------------------|---------------|-----------------------|------------------------------------|------------------------|--------------------|-------------------------------------------------|--------------------------------------|-----------------------------------------|---------|------------|----------------------------|-------------------------------|
| Liliopsida (monocots) | <i>Phragmites australis</i>    | Common reed           | LOEC             | Growth (Leaves and Stems)                                | 504           | LT                    | P/S (salt tolerant)                | SR                     | 7091               | 500                                             | N/S                                  | N/S                                     | N/S     | 25         | Juvenile                   | Gorai <i>et al.</i> (2010)    |
| Liliopsida (monocots) | <i>Phragmites australis</i>    | Common reed           | LOEC             | Physiology (proline conc. - indicator of osmotic stress) | 504           | LT                    | P/S (salt tolerant)                | SR                     | 1773               | 500                                             | N/S                                  | N/S                                     | N/S     | 25         | Juvenile                   | Gorai <i>et al.</i> (2010)    |
| Liliopsida (monocots) | <i>Phragmites australis</i>    | Common reed           | LOEC             | Growth (leaves and stems)                                | 504           | LT                    | P/S (salt tolerant)                | SR                     | 10636              | 500                                             | N/S                                  | N/S                                     | 6.5     | 25         | Juvenile                   | Gorai <i>et al.</i> (2011)    |
| Liliopsida (monocots) | <i>Phragmites australis</i>    | Common reed           | LOEC             | Growth (roots)                                           | 504           | LT                    | P/S (salt tolerant)                | SR                     | 48032              | 500                                             | N/S                                  | N/S                                     | 6.5     | 25         | Juvenile                   | Gorai <i>et al.</i> (2011)    |
| Liliopsida (monocots) | <i>Phragmites australis</i>    | Common reed           | LOEC             | Physiology (proline conc. - indicator of osmotic stress) | 504           | LT                    | P/S (salt tolerant)                | SR                     | 6102               | 500                                             | N/S                                  | N/S                                     | N/S     | 25         | Juvenile                   | Gorai <i>et al.</i> (2011)    |
| Liliopsida (monocots) | <i>Spirodela polyrrhiza</i>    | Greater duckweed      | EC <sub>50</sub> | Physiology (chlorophyll b content)                       | 144           | LT                    | P/S                                | S                      | 7091               | 298                                             | N/S                                  | N/S                                     | N/S     | 25         | Adult                      | Chang <i>et al.</i> (2012)    |
| Liliopsida (monocots) | <i>Spirodela polyrrhiza</i>    | Greater duckweed      | EC <sub>50</sub> | Physiology (chlorophyll b content)                       | 288           | LT                    | P/S                                | S                      | 7091               | 298                                             | N/S                                  | N/S                                     | N/S     | 25         | Adult                      | Chang <i>et al.</i> (2012)    |
| Magnoliopsida         | <i>Myriophyllum spicatum</i>   | Eurasian watermilfoil | IC <sub>50</sub> | Dry root weight                                          | 768           | LT                    | P/S                                | S                      | 4964               | 96                                              | N/S                                  | N/S                                     | N/S     | 20         | Adult                      | Stanley (1974)                |
| Magnoliopsida         | <i>Myriophyllum spicatum</i>   | Eurasian watermilfoil | IC <sub>50</sub> | Dry shoot weight                                         | 768           | LT                    | P/S                                | S                      | 3617               | 96                                              | N/S                                  | N/S                                     | N/S     | 20         | Adult                      | Stanley (1974)                |
| Magnoliopsida         | <i>Myriophyllum spicatum</i>   | Eurasian watermilfoil | IC <sub>50</sub> | Root length                                              | 768           | LT                    | P/S                                | S                      | 4858               | 96                                              | N/S                                  | N/S                                     | N/S     | 20         | Adult                      | Stanley (1974)                |
| Magnoliopsida         | <i>Myriophyllum spicatum</i>   | Eurasian watermilfoil | IC <sub>50</sub> | Shoot length                                             | 768           | LT                    | P/S                                | S                      | 4503               | 96                                              | N/S                                  | N/S                                     | N/S     | 20         | Adult                      | Stanley (1974)                |
| Magnoliopsida         | <i>Stuckenia pectinata</i>     | Sago pondweed         | EC <sub>50</sub> | Reproduction (germination success)                       | 672           | LT                    | P/S                                | S                      | 1820               | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Teeter (1965)                 |
| Malacostraca          | <i>Asellus communis</i>        | Isopod (sow bug)      | LC <sub>50</sub> | Mortality                                                | 168           | Chronic               | U (no mention of control survival) | S                      | 3731               | 100                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Wurtz & Bridges (1961)        |
| Malacostraca          | <i>Gammarus pseudolimnaeus</i> | Amphipod              | NOEC             | Mortality                                                | 1440          | LT                    | P/S                                | S                      | 2000               | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Williamset al. (1999)         |
| Malacostraca          | <i>Hyalella azteca</i>         | Amphipod              | LC <sub>10</sub> | Mortality                                                | 168           | Chronic               | P/S                                | S                      | 831                | 125                                             | N/S                                  | >6.3                                    | 7.8-9.9 | 25         | 48-240 h old Juvenile      | Bartlett <i>et al.</i> (2012) |
| Malacostraca          | <i>Hyalella azteca</i>         | Amphipod              | LC <sub>10</sub> | Mortality                                                | 336           | Chronic               | P/S                                | S                      | 842                | 125                                             | N/S                                  | >6.3                                    | 7.8-9.9 | 25         | 48-240 h old Juvenile      | Bartlett <i>et al.</i> (2012) |
| Malacostraca          | <i>Hyalella azteca</i>         | Amphipod              | LC <sub>10</sub> | Mortality                                                | 504           | LT                    | P/S                                | S                      | 781                | 125                                             | N/S                                  | >6.3                                    | 7.8-9.9 | 25         | 48-240 h old Juvenile      | Bartlett <i>et al.</i> (2012) |
| Malacostraca          | <i>Hyalella azteca</i>         | Amphipod              | LC <sub>10</sub> | Mortality                                                | 672           | LT                    | P/S                                | S                      | 733                | 125                                             | N/S                                  | >6.3                                    | 7.8-9.9 | 25         | 48-240 h old Juvenile      | Bartlett <i>et al.</i> (2012) |
| Malacostraca          | <i>Hyalella azteca</i>         | Amphipod              | LC <sub>25</sub> | Mortality                                                | 168           | Chronic               | P/S                                | S                      | 1140               | 125                                             | N/S                                  | >6.3                                    | 7.8-9.9 | 25         | 48-240 h old Juvenile      | Bartlett <i>et al.</i> (2012) |
| Malacostraca          | <i>Hyalella azteca</i>         | Amphipod              | LC <sub>25</sub> | Mortality                                                | 336           | Chronic               | P/S                                | S                      | 1050               | 125                                             | N/S                                  | >6.3                                    | 7.8-9.9 | 25         | 48-240 h old Juvenile      | Bartlett <i>et al.</i> (2012) |
| Malacostraca          | <i>Hyalella azteca</i>         | Amphipod              | LC <sub>25</sub> | Mortality                                                | 504           | LT                    | P/S                                | S                      | 998                | 125                                             | N/S                                  | >6.3                                    | 7.8-9.9 | 25         | 48-240 h old Juvenile      | Bartlett <i>et al.</i> (2012) |

Table A-1. LONG-TERM/ CHRONIC DATA - NaCl, KCl, CaCl<sub>2</sub>, and MgCl<sub>2</sub> SALTS

| Class        | Species                        | Common name      | Endpoint           | Endpoint criteria            | Exp. time (h) | LT (SSD) <sup>A</sup> | Data quality <sup>B</sup> | Exp. type <sup>C</sup> | Chloride (mg Cl/L) | Hardness <sup>D</sup> (mg CaCO <sub>3</sub> /L) | Alkalinity (mg CaCO <sub>3</sub> /L) | Dissolved oxygen (mg O <sub>2</sub> /L) | pH      | Temp. (°C) | Life stage characteristics | Citation                     |
|--------------|--------------------------------|------------------|--------------------|------------------------------|---------------|-----------------------|---------------------------|------------------------|--------------------|-------------------------------------------------|--------------------------------------|-----------------------------------------|---------|------------|----------------------------|------------------------------|
| Malacostraca | <i>Hyalella azteca</i>         | Amphipod         | LC <sub>25</sub>   | Mortality                    | 672           | LT                    | P/S                       | S                      | 954                | 125                                             | N/S                                  | >6.3                                    | 7.8-9.9 | 25         | 48-240 h old Juvenile      | Bartlett et al. (2012)       |
| Malacostraca | <i>Hyalella azteca</i>         | Amphipod         | LC <sub>50</sub>   | Mortality                    | 168           | Chronic               | P/S                       | S                      | 1510               | 125                                             | N/S                                  | >6.3                                    | 7.8-9.9 | 25         | 48-240 h old Juvenile      | Bartlett et al. (2012)       |
| Malacostraca | <i>Hyalella azteca</i>         | Amphipod         | LC <sub>50</sub>   | Mortality                    | 336           | Chronic               | P/S                       | S                      | 1280               | 125                                             | N/S                                  | >6.3                                    | 7.8-9.9 | 25         | 48-240 h old Juvenile      | Bartlett et al. (2012)       |
| Malacostraca | <i>Hyalella azteca</i>         | Amphipod         | LC <sub>50</sub>   | Mortality                    | 504           | Chronic               | P/S                       | S                      | 1240               | 125                                             | N/S                                  | >6.3                                    | 7.8-9.9 | 25         | 48-240 h old Juvenile      | Bartlett et al. (2012)       |
| Malacostraca | <i>Hyalella azteca</i>         | Amphipod         | LC <sub>50</sub>   | Mortality                    | 672           | Chronic               | P/S                       | S                      | 1200               | 125                                             | N/S                                  | >6.3                                    | 7.8-9.9 | 25         | 48-240 h old Juvenile      | Bartlett et al. (2012)       |
| Malacostraca | <i>Hyalella azteca</i>         | Amphipod         | EC <sub>25</sub>   | Growth, dry weight/ amphipod | 672           | LT                    | P/S                       | S                      | 421                | 125                                             | N/S                                  | >6.3                                    | 7.8-9.9 | 25         | 48-240 h old Juvenile      | Bartlett et al. (2012)       |
| Malacostraca | <i>Hyalella azteca</i>         | Amphipod         | IC <sub>25</sub>   | Biomass                      | 672           | LT                    | P/S                       | SR                     | 1186               | 85                                              | 60                                   | N/S                                     | 7.4-7.8 | 23         | 168-192 h old              | Elphick et al. (2011a)       |
| Malacostraca | <i>Hyalella azteca</i>         | Amphipod         | IC <sub>50</sub>   | Biomass                      | 672           | LT                    | P/S                       | SR                     | 2298               | 85                                              | 60                                   | N/S                                     | 7.4-7.8 | 23         | 168-192 h old              | Elphick et al. (2011a)       |
| Malacostraca | <i>Hyalella azteca</i>         | Amphipod         | NOEC               | Biomass                      | 672           | LT                    | P/S                       | SR                     | 2210               | 85                                              | 60                                   | N/S                                     | 7.4-7.8 | 23         | 168-192 h old              | Elphick et al. (2011a)       |
| Malacostraca | <i>Hyalella azteca</i>         | Amphipod         | LOEC               | Biomass                      | 672           | LT                    | P/S                       | SR                     | 4237               | 85                                              | 60                                   | N/S                                     | 7.4-7.8 | 23         | 168-192 h old              | Elphick et al. (2011a)       |
| Monogononta  | <i>Brachionus calyciflorus</i> | Rotifer          | IC <sub>10</sub>   | Reproduction                 | 48            | LT                    | P/S                       | SR                     | 1241               | 85                                              | 60                                   | N/S                                     | 7.4-7.8 | 25         | < 4 h old                  | Elphick et al. (2011a)       |
| Monogononta  | <i>Brachionus calyciflorus</i> | Rotifer          | IC <sub>25</sub>   | Reproduction                 | 48            | LT                    | P/S                       | SR                     | 1505               | 85                                              | 60                                   | N/S                                     | 7.4-7.8 | 25         | < 4 h old                  | Elphick et al. (2011a)       |
| Monogononta  | <i>Brachionus calyciflorus</i> | Rotifer          | IC <sub>50</sub>   | Reproduction                 | 48            | LT                    | P/S                       | SR                     | 1945               | 85                                              | 60                                   | N/S                                     | 7.4-7.8 | 25         | < 4 h old                  | Elphick et al. (2011a)       |
| Monogononta  | <i>Brachionus calyciflorus</i> | Rotifer          | NOEC               | Reproduction                 | 48            | LT                    | P/S                       | SR                     | 1120               | 85                                              | 60                                   | N/S                                     | 7.4-7.8 | 25         | < 4 h old                  | Elphick et al. (2011a)       |
| Monogononta  | <i>Brachionus calyciflorus</i> | Rotifer          | LOEC               | Reproduction                 | 48            | LT                    | P/S                       | SR                     | 2330               | 85                                              | 60                                   | N/S                                     | 7.4-7.8 | 25         | < 4 h old                  | Elphick et al. (2011a)       |
| Monogononta  | <i>Brachionus patulus</i>      | Rotifer          | NOEC               | Population increase          | 336           | LT                    | P/S                       | SR                     | 1213               | 85                                              | N/S                                  | N/S                                     | 7.2-7.5 | 23-27      | Adult                      | Peredo-Alvarez et al. (2003) |
| Monogononta  | <i>Brachionus patulus</i>      | Rotifer          | See footnotes E(4) | Population increase          | 336           | Chronic               | P/S                       | SR                     | 1820               | 85                                              | N/S                                  | N/S                                     | 7.2-7.5 | 23-27      | Adult                      | Peredo-Alvarez et al. (2003) |
| Monogononta  | <i>Brachionus patulus</i>      | Rotifer          | See footnotes E(5) | Population increase          | 480           | Chronic               | P/S                       | SR                     | 1213               | 85                                              | N/S                                  | N/S                                     | 7.2-7.5 | 23-27      | Adult                      | Peredo-Alvarez et al. (2003) |
| Monogononta  | <i>Brachionus patulus</i>      | Rotifer          | See footnotes E(6) | Population increase          | 480           | Chronic               | P/S                       | SR                     | 1213               | 85                                              | N/S                                  | N/S                                     | 7.2-7.5 | 23-27      | Adult                      | Peredo-Alvarez et al. (2003) |
| Monogononta  | <i>Brachionus patulus</i>      | Rotifer          | See footnotes E(7) | Population increase          | 480           | Chronic               | P/S                       | SR                     | 1213               | 85                                              | N/S                                  | N/S                                     | 7.2-7.5 | 23-27      | Adult                      | Peredo-Alvarez et al. (2003) |
| Oomycota     | <i>Saprolegnia ferax</i>       | Freshwater mould | EC <sub>100</sub>  | Growth                       | 72            | Chronic               | ? ?                       | ?                      | 21231              | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | Adult                      | Perruciet al. (1995)         |
| Oomycota     | <i>Saprolegnia ferax</i>       | Freshwater mould | EC <sub>100</sub>  | Growth                       | 72            | Chronic               | ? ?                       | ?                      | 16985              | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | Adult                      | Perruciet al. (1995)         |

Table A-1. LONG-TERM/ CHRONIC DATA - NaCl, KCl, CaCl<sub>2</sub>, and MgCl<sub>2</sub> SALTS

| Class           | Species                         | Common name   | Endpoint         | Endpoint criteria                    | Exp. time (h) | LT (SSD) <sup>A</sup> | Data quality <sup>B</sup>                | Exp. type <sup>C</sup> | Chloride (mg Cl/L) | Hardness <sup>D</sup> (mg CaCO <sub>3</sub> /L) | Alkalinity (mg CaCO <sub>3</sub> /L) | Dissolved oxygen (mg O <sub>2</sub> /L) | pH      | Temp. (°C) | Life stage characteristics | Citation                                                 |
|-----------------|---------------------------------|---------------|------------------|--------------------------------------|---------------|-----------------------|------------------------------------------|------------------------|--------------------|-------------------------------------------------|--------------------------------------|-----------------------------------------|---------|------------|----------------------------|----------------------------------------------------------|
| Polypodiopsida  | <i>Salvinia natans</i>          | Floating fern | LOEC             | Growth                               | 336           | LT                    | P/S                                      | S                      | 1773               | N/S                                             | N/S                                  | N/S                                     | 7       | 25         | Adult                      | Jampeetong & Brix (2009)                                 |
| Polypodiopsida  | <i>Salvinia natans</i>          | Floating fern | LOEC             | Physiology (Photosynthetic capacity) | 336           | LT                    | P/S                                      | S                      | 4803               | N/S                                             | N/S                                  | N/S                                     | 7       | 25         | Adult                      | Jampeetong & Brix (2009)                                 |
| Sphagnopsida    | <i>Sphagnum fimbriatum</i>      | Sphagnum moss | LOEC             | Growth (length)                      | 1800          | LT                    | U (Natural water used as dilution water) | S                      | 400                | N/S                                             | N/S                                  | N/S                                     | N/S     | 19         | N/S                        | Wilcox & Andrus (1987)                                   |
| Trebuxiophyceae | <i>Chlorella emersonii</i>      | Green alga    | MATC             | Growth                               | 192-336       | LT                    | P/S                                      | N/S                    | 6824               | 150                                             | N/S                                  | N/S                                     | 5.5-6.5 | 29.8-30.2  | Adult                      | Setteret al. (1982)                                      |
| Trebuxiophyceae | <i>Chlorella fusca</i>          | Green algae   | MATC             | Growth                               | 672           | LT                    | P/S (salt tolerant)                      | ?                      | 18200              | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Kessler (1974)                                           |
| Trebuxiophyceae | <i>Chlorella kessleri</i>       | Green algae   | MATC             | Growth                               | 672           | LT                    | P/S (salt tolerant)                      | ?                      | 18200              | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Kessler (1974)                                           |
| Trebuxiophyceae | <i>Chlorella luteoviridis</i>   | Green algae   | MATC             | Growth                               | 672           | LT                    | P/S (salt tolerant)                      | ?                      | 36400              | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Kessler (1974)                                           |
| Trebuxiophyceae | <i>Chlorella minutissima</i>    | Green algae   | MATC             | Growth                               | 672           | LT                    | P/S                                      | ?                      | 6066               | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Kessler (1974)                                           |
| Trebuxiophyceae | <i>Chlorella protothecoides</i> | Green algae   | MATC             | Growth                               | 672           | LT                    | P/S (salt tolerant)                      | ?                      | 30300              | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Kessler (1974)                                           |
| Trebuxiophyceae | <i>Chlorella saccharophylla</i> | Green algae   | MATC             | Growth                               | 672           | LT                    | P/S (salt tolerant)                      | ?                      | 30300              | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Kessler (1974)                                           |
| Trebuxiophyceae | <i>Chlorella vulgaris</i>       | Green algae   | LOEC             | Population Growth                    | 2192-2922     | LT                    | U (Control survival not reported)        | S                      | 412                | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | DeJonge (1965)                                           |
| Trebuxiophyceae | <i>Chlorella vulgaris</i>       | Green algae   | NOEC             | Population Growth                    | 2192-2922     | LT                    | U (Control survival not reported)        | S                      | 358                | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | DeJonge (1965)                                           |
| Trebuxiophyceae | <i>Chlorella vulgaris</i>       | Green algae   | MATC             | Growth                               | 672           | LT                    | P/S (salt tolerant)                      | ?                      | 18200              | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Kessler (1974)                                           |
| Trebuxiophyceae | <i>Chlorella vulgaris</i>       | Green algae   | EC <sub>10</sub> | Biomass                              | 360           | LT                    | P/S                                      | S                      | 506                | N/S                                             | N/S                                  | N/S                                     | 6.8-7.2 | 27         | 72 hr                      | Singh et al. (2018); EEI calculation from available data |
| Trebuxiophyceae | <i>Chlorella vulgaris</i>       | Green algae   | EC <sub>10</sub> | Protein                              | 360           | LT                    | P/S                                      | S                      | 576                | N/S                                             | N/S                                  | N/S                                     | 6.8-7.2 | 27         | 72 hr                      | Singh et al. (2018); EEI calculation from available data |
| Trebuxiophyceae | <i>Chlorella vulgaris</i>       | Green algae   | EC <sub>10</sub> | Carbohydrate                         | 360           | LT                    | P/S                                      | S                      | 1406               | N/S                                             | N/S                                  | N/S                                     | 6.8-7.2 | 27         | 72 hr                      | Singh et al. (2018); EEI calculation from available data |
| Trebuxiophyceae | <i>Chlorella vulgaris</i>       | Green algae   | EC <sub>10</sub> | Total lipid                          | 360           | LT                    | P/S                                      | S                      | 14993              | N/S                                             | N/S                                  | N/S                                     | 6.8-7.2 | 27         | 72 hr                      | Singh et al. (2018); EEI calculation from available data |
| Trebuxiophyceae | <i>Chlorella zoofingensis</i>   | Green algae   | MATC             | Growth                               | 672           | LT                    | P/S                                      | ?                      | 6066               | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Kessler (1974)                                           |
| Trebuxiophyceae | <i>Chlorococcum humicola</i>    | Green algae   | EC <sub>10</sub> | Biomass                              | 360           | LT                    | P/S                                      | S                      | 1518               | N/S                                             | N/S                                  | N/S                                     | 6.8-7.2 | 27         | 72 hr                      | Singh et al. (2018); EEI calculation from available data |
| Trebuxiophyceae | <i>Chlorococcum humicola</i>    | Green algae   | EC <sub>10</sub> | Protein                              | 360           | LT                    | P/S                                      | S                      | 824                | N/S                                             | N/S                                  | N/S                                     | 6.8-7.2 | 27         | 72 hr                      | Singh et al. (2018); EEI calculation from available data |

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| Class            | Species                    | Common name    | Endpoint         | Endpoint criteria | Exp. time (h) | LT (SSD) <sup>A</sup> | Data quality <sup>B</sup> | Exp. type <sup>C</sup> | Chloride (mg Cl/L) | Hardness <sup>D</sup> (mg CaCO <sub>3</sub> /L) | Alkalinity (mg CaCO <sub>3</sub> /L) | Dissolved oxygen (mg O <sub>2</sub> /L) | pH      | Temp. (°C) | Life stage characteristics | Citation                                                        |
|------------------|----------------------------|----------------|------------------|-------------------|---------------|-----------------------|---------------------------|------------------------|--------------------|-------------------------------------------------|--------------------------------------|-----------------------------------------|---------|------------|----------------------------|-----------------------------------------------------------------|
| Trebouxiophyceae | Chlorococcum humicola      | Green algae    | EC <sub>10</sub> | Carbohydrate      | 360           | LT                    | P/S                       | S                      | 3318               | N/S                                             | N/S                                  | N/S                                     | 6.8-7.2 | 27         | 72 hr                      | Singh <i>et al.</i> (2018); EEI calculation from available data |
| Trebouxiophyceae | Chlorococcum humicola      | Green algae    | EC <sub>10</sub> | Total lipid       | 360           | LT                    | P/S                       | S                      | 13074              | N/S                                             | N/S                                  | N/S                                     | 6.8-7.2 | 27         | 72 hr                      | Singh <i>et al.</i> (2018); EEI calculation from available data |
| <b>KCl</b>       |                            |                |                  |                   |               |                       |                           |                        |                    |                                                 |                                      |                                         |         |            |                            |                                                                 |
| Actinopterygii   | <i>Oncorhynchus mykiss</i> | Rainbow trout  | LC <sub>50</sub> | Mortality         | 168           | Chronic               | P/S                       | SR                     | 1050               | 85                                              | 57-64                                | >40 % sat                               | 7.4-7.8 | 15         | Fry (360-600 h old)        | Lazorchak & Smith (2007)                                        |
| Actinopterygii   | <i>Oncorhynchus mykiss</i> | Rainbow trout  | NOEC             | Growth            | 168           | LT                    | P/S                       | SR                     | 594                | 85                                              | 57-64                                | >40 % sat                               | 7.4-7.8 | 15         | Fry (360-600 h old)        | Lazorchak & Smith (2007)                                        |
| Actinopterygii   | <i>Oncorhynchus mykiss</i> | Rainbow trout  | IC <sub>25</sub> | Growth            | 168           | LT                    | P/S                       | SR                     | 835                | 85                                              | 57-64                                | >40 % sat                               | 7.4-7.8 | 15         | Fry (360-600 h old)        | Lazorchak & Smith (2007)                                        |
| Actinopterygii   | <i>Oncorhynchus mykiss</i> | Rainbow trout  | NOEC             | Mortality         | 168           | Chronic               | P/S                       | SR                     | 713                | 85                                              | 57-64                                | >40 % sat                               | 7.4-7.8 | 15         | Fry (360-600 h old)        | Lazorchak & Smith (2007)                                        |
| Actinopterygii   | <i>Pimephales promelas</i> | Fathead minnow | NOEC             | Survival          | 168           | LT                    | P/S                       | S                      | 238                | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 24 h old larva             | Pickering <i>et al.</i> (1996)                                  |
| Actinopterygii   | <i>Pimephales promelas</i> | Fathead minnow | NOEC             | Survival          | 168           | LT                    | P/S                       | S                      | 238                | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 96 h old larva             | Pickering <i>et al.</i> (1996)                                  |
| Actinopterygii   | <i>Pimephales promelas</i> | Fathead minnow | NOEC             | Survival          | 168           | LT                    | P/S                       | S                      | 238                | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 168 h old larva            | Pickering <i>et al.</i> (1996)                                  |
| Actinopterygii   | <i>Pimephales promelas</i> | Fathead minnow | NOEC             | Survival          | 168           | LT                    | P/S                       | S                      | 238                | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 24 h old larva             | Pickering <i>et al.</i> (1996)                                  |
| Actinopterygii   | <i>Pimephales promelas</i> | Fathead minnow | NOEC             | Survival          | 168           | LT                    | P/S                       | S                      | 238                | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 96 h old larva             | Pickering <i>et al.</i> (1996)                                  |
| Actinopterygii   | <i>Pimephales promelas</i> | Fathead minnow | NOEC             | Survival          | 168           | LT                    | P/S                       | S                      | 238                | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 168 h old larva            | Pickering <i>et al.</i> (1996)                                  |
| Actinopterygii   | <i>Pimephales promelas</i> | Fathead minnow | LOEC             | Survival          | 168           | LT                    | P/S                       | S                      | 476                | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 24 h old larva             | Pickering <i>et al.</i> (1996)                                  |
| Actinopterygii   | <i>Pimephales promelas</i> | Fathead minnow | LOEC             | Survival          | 168           | LT                    | P/S                       | S                      | 476                | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 96 h old larva             | Pickering <i>et al.</i> (1996)                                  |
| Actinopterygii   | <i>Pimephales promelas</i> | Fathead minnow | LOEC             | Survival          | 168           | LT                    | P/S                       | S                      | 476                | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 168 h old larva            | Pickering <i>et al.</i> (1996)                                  |
| Actinopterygii   | <i>Pimephales promelas</i> | Fathead minnow | LOEC             | Survival          | 168           | LT                    | P/S                       | S                      | 476                | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 24 h old larva             | Pickering <i>et al.</i> (1996)                                  |
| Actinopterygii   | <i>Pimephales promelas</i> | Fathead minnow | LOEC             | Survival          | 168           | LT                    | P/S                       | S                      | 476                | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 96 h old larva             | Pickering <i>et al.</i> (1996)                                  |
| Actinopterygii   | <i>Pimephales promelas</i> | Fathead minnow | LOEC             | Survival          | 168           | LT                    | P/S                       | S                      | 476                | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 168 h old larva            | Pickering <i>et al.</i> (1996)                                  |
| Actinopterygii   | <i>Pimephales promelas</i> | Fathead minnow | LOEC             | Survival          | 168           | LT                    | P/S                       | S                      | 476                | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 24 h old larva             | Pickering <i>et al.</i> (1996)                                  |
| Actinopterygii   | <i>Pimephales promelas</i> | Fathead minnow | LOEC             | Survival          | 168           | LT                    | P/S                       | S                      | 476                | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 96 h old larva             | Pickering <i>et al.</i> (1996)                                  |
| Actinopterygii   | <i>Pimephales promelas</i> | Fathead minnow | LOEC             | Survival          | 168           | LT                    | P/S                       | S                      | 476                | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 168 h old larva            | Pickering <i>et al.</i> (1996)                                  |
| Actinopterygii   | <i>Pimephales promelas</i> | Fathead minnow | LOEC             | Growth            | 168           | LT                    | P/S                       | S                      | 238                | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 24 h old larva             | Pickering <i>et al.</i> (1996)                                  |
| Actinopterygii   | <i>Pimephales promelas</i> | Fathead minnow | NOEC             | Growth            | 168           | LT                    | P/S                       | S                      | 238                | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 96 h old larva             | Pickering <i>et al.</i> (1996)                                  |
| Actinopterygii   | <i>Pimephales promelas</i> | Fathead minnow | NOEC             | Growth            | 168           | LT                    | P/S                       | S                      | 238                | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 168 h old larva            | Pickering <i>et al.</i> (1996)                                  |
| Actinopterygii   | <i>Pimephales promelas</i> | Fathead minnow | NOEC             | Growth            | 168           | LT                    | P/S                       | S                      | 238                | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 24 h old larva             | Pickering <i>et al.</i> (1996)                                  |
| Actinopterygii   | <i>Pimephales promelas</i> | Fathead minnow | NOEC             | Growth            | 168           | LT                    | P/S                       | S                      | 238                | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 96 h old larva             | Pickering <i>et al.</i> (1996)                                  |



Table A-1. LONG-TERM/ CHRONIC DATA - NaCl, KCl, CaCl<sub>2</sub>, and MgCl<sub>2</sub> SALTS

| Class             | Species                                | Common name     | Endpoint         | Endpoint criteria                    | Exp. time (h) | LT (SSD) <sup>A</sup> | Data quality <sup>B</sup>           | Exp. type <sup>C</sup> | Chloride (mg Cl/L) | Hardness <sup>D</sup> (mg CaCO <sub>3</sub> /L) | Alkalinity (mg CaCO <sub>3</sub> /L) | Dissolved oxygen (mg O <sub>2</sub> /L) | pH      | Temp. (°C) | Life stage characteristics | Citation                           |
|-------------------|----------------------------------------|-----------------|------------------|--------------------------------------|---------------|-----------------------|-------------------------------------|------------------------|--------------------|-------------------------------------------------|--------------------------------------|-----------------------------------------|---------|------------|----------------------------|------------------------------------|
| Actinopterygii    | <i>Pimephales promelas</i>             | Fathead minnow  | NOEC             | Growth                               | 168           | LT                    | P/S                                 | S                      | 238                | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 24 h old larva             | Pickering et al. (1996)            |
| Actinopterygii    | <i>Pimephales promelas</i>             | Fathead minnow  | NOEC             | Growth                               | 168           | LT                    | P/S                                 | S                      | 238                | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 96 h old larva             | Pickering et al. (1996)            |
| Actinopterygii    | <i>Pimephales promelas</i>             | Fathead minnow  | NOEC             | Growth                               | 168           | LT                    | P/S                                 | S                      | 119                | 85                                              | 56-64                                | >60 % sat                               | 7.2-7.8 | 24-26      | 168 h old larva            | Pickering et al. (1996)            |
| Actinopterygii    | <i>Salvelinus fontinalis</i>           | Brook trout     | LC <sub>50</sub> | Mortality                            | 168           | Chronic               | P/S                                 | SR                     | 1365               | 85                                              | 57-64                                | >40 % sat                               | 7.4-7.8 | 15         | Fry (720-1080 h old)       | Lazorchak & Smith (2007)           |
| Actinopterygii    | <i>Salvelinus fontinalis</i>           | Brook trout     | NOEC             | Growth                               | 168           | LT                    | P/S                                 | SR                     | 951                | 85                                              | 57-64                                | >40 % sat                               | 7.4-7.8 | 15         | Fry (720-1080 h old)       | Lazorchak & Smith (2007)           |
| Actinopterygii    | <i>Salvelinus fontinalis</i>           | Brook trout     | IC <sub>25</sub> | Growth                               | 168           | LT                    | P/S                                 | SR                     | 1187               | 85                                              | 57-64                                | >40 % sat                               | 7.4-7.8 | 15         | Fry (720-1080 h old)       | Lazorchak & Smith (2007)           |
| Actinopterygii    | <i>Salvelinus fontinalis</i>           | Brook trout     | NOEC             | Mortality                            | 168           | Chronic               | P/S                                 | SR                     | 951                | 85                                              | 57-64                                | >40 % sat                               | 7.4-7.8 | 15         | Fry (720-1080 h old)       | Lazorchak & Smith (2007)           |
| Bacillariophyceae | <i>Nitzschia linearis</i>              | Diatom          | LC <sub>50</sub> | Mortality                            | 120           | Chronic               | ? U (control survival not reported) | S                      | 636                | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Patrick et al. (1968)              |
| Bacillariophyceae | <i>Navicula seminulum</i>              | Diatom          | LC <sub>50</sub> | Mortality                            | 96            | LT                    | P/S                                 | S                      | 636                | 10                                              | N/S                                  | 8                                       | N/S     | 22         | N/S                        | Academy of Natural Sciences (1960) |
| Bivalvia          | <i>Musculum transversum</i>            | Fingernail clam | MATC             | Mortality                            | 1008          | LT                    | P/S                                 | S                      | 213                | 212                                             | N/S                                  | 7.67                                    | 8.13    | 24         | Adult                      | Anderson et al. (1978)             |
| Bivalvia          | <i>Musculum transversum</i>            | Fingernail clam | NOEC             | Mortality                            | 1008          | LT                    | P/S                                 | S                      | 177                | 212                                             | N/S                                  | 7.67                                    | 8.13    | 24         | Adult                      | Anderson et al. (1978)             |
| Branchiopoda      | <i>Daphnia magna</i>                   | Water flea      | LC <sub>50</sub> | Mortality                            | 504           | Chronic               | P/S                                 | SR                     | 88                 | 45                                              | 42                                   | 9                                       | 7.4-8.2 | 17-19      | 12-24 h old                | Biesinger & Christensen (1972)     |
| Branchiopoda      | <i>Daphnia magna</i>                   | Water flea      | IC <sub>50</sub> | Reproduction                         | 504           | LT                    | P/S                                 | SR                     | 62                 | 45                                              | 42                                   | 9                                       | 7.4-8.2 | 17-19      | 12-24 h old                | Biesinger & Christensen (1972)     |
| Branchiopoda      | <i>Daphnia magna</i>                   | Water flea      | IC <sub>16</sub> | Reproduction                         | 504           | LT                    | P/S                                 | SR                     | 48                 | 45                                              | 42                                   | 9                                       | 7.4-8.2 | 17-19      | 12-24 h old                | Biesinger & Christensen (1972)     |
| Chlorophyceae     | <i>Pseudokirchneriella subcapitata</i> | Green algae     | EC <sub>10</sub> | Population growth (log cell density) | 96            | LT                    | P/S                                 | N/S                    | 113                | 15                                              | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Simmons (2012)                     |
| Chlorophyceae     | <i>Pseudokirchneriella subcapitata</i> | Green algae     | EC <sub>10</sub> | Population growth (fluorescence)     | 96            | LT                    | P/S                                 | N/S                    | 106                | 15                                              | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Simmons (2012)                     |
| Chlorophyceae     | <i>Pseudokirchneriella subcapitata</i> | Green algae     | EC <sub>50</sub> | Population growth (log cell density) | 96            | LT                    | P/S                                 | N/S                    | 425                | 15                                              | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Simmons (2012)                     |
| Chlorophyceae     | <i>Pseudokirchneriella subcapitata</i> | Green algae     | EC <sub>50</sub> | Population growth (fluorescence)     | 96            | LT                    | P/S                                 | N/S                    | 425                | 15                                              | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Simmons (2012)                     |
| Chlorophyceae     | <i>Desmodesmus subspicatus</i>         | Green algae     | EC <sub>50</sub> | Population Growth                    | 72            | LT                    | P/S                                 | S                      | 6372               | N/S                                             | N/S                                  | N/S                                     | N/S     | 23         | Adult                      | Eisentraeger et al. (2003)         |
| Chlorophyceae     | <i>Desmodesmus subspicatus</i>         | Green algae     | EC <sub>50</sub> | Population Growth                    | 72            | LT                    | P/S                                 | S                      | 6372               | N/S                                             | N/S                                  | N/S                                     | N/S     | 23         | Adult                      | Eisentraeger et al. (2003)         |
| Chlorophyceae     | <i>Desmodesmus subspicatus</i>         | Green algae     | EC <sub>50</sub> | Population Growth                    | 72            | LT                    | P/S                                 | S                      | 5944               | N/S                                             | N/S                                  | N/S                                     | N/S     | 23         | Adult                      | Eisentraeger et al. (2003)         |

Table A-1. LONG-TERM/ CHRONIC DATA - NaCl, KCl, CaCl<sub>2</sub>, and MgCl<sub>2</sub> SALTS

| Class                   | Species                                | Common name     | Endpoint         | Endpoint criteria                    | Exp. time (h) | LT (SSD) <sup>A</sup> | Data quality <sup>B</sup>           | Exp. type <sup>C</sup> | Chloride (mg Cl/L) | Hardness <sup>D</sup> (mg CaCO <sub>3</sub> /L) | Alkalinity (mg CaCO <sub>3</sub> /L) | Dissolved oxygen (mg O <sub>2</sub> /L) | pH      | Temp. (°C) | Life stage characteristics | Citation                           |
|-------------------------|----------------------------------------|-----------------|------------------|--------------------------------------|---------------|-----------------------|-------------------------------------|------------------------|--------------------|-------------------------------------------------|--------------------------------------|-----------------------------------------|---------|------------|----------------------------|------------------------------------|
| Chlorophyceae           | <i>Desmodesmus subspicatus</i>         | Green algae     | EC <sub>50</sub> | Population Growth                    | 72            | LT                    | P/S                                 | S                      | 4508               | N/S                                             | N/S                                  | N/S                                     | N/S     | 23         | Adult                      | Eisentraeger et al. (2003)         |
| Chlorophyceae           | <i>Desmodesmus subspicatus</i>         | Green algae     | EC <sub>50</sub> | Population Growth                    | 72            | LT                    | P/S                                 | S                      | 4394               | N/S                                             | N/S                                  | N/S                                     | N/S     | 23         | Adult                      | Eisentraeger et al. (2003)         |
| Cyanophyceae            | <i>Anabaena azotica</i>                | Cyanobacteria   | NOEC             | Population Growth                    | 96            | LT                    | P/S                                 | S                      | 1773               | N/S                                             | N/S                                  | N/S                                     | 8.3     | 25         | Adult                      | Dai et al. (2008)                  |
| Cyanophyceae            | <i>Microcystis aeruginosa</i>          | Cyanobacteria   | LOEC             | Population Growth                    | 96            | LT                    | P/S                                 | S                      | 1773               | N/S                                             | N/S                                  | N/S                                     | 8.3     | 25         | Adult                      | Dai et al. (2008)                  |
| Cyanophyceae            | <i>Microcystis aeruginosa</i>          | Cyanobacteria   | NOEC             | Population Growth                    | 96            | LT                    | P/S                                 | S                      | 1773               | N/S                                             | N/S                                  | N/S                                     | 8.3     | 25         | Adult                      | Dai et al. (2008)                  |
| Cyanophyceae            | <i>Microcystis aeruginosa</i>          | Cyanobacteria   | NOEC             | Population Growth                    | 96            | LT                    | P/S                                 | S                      | 355                | N/S                                             | N/S                                  | N/S                                     | 8.3     | 25         | Adult                      | Dai et al. (2008)                  |
| Cyanophyceae            | <i>Microcystis aeruginosa</i>          | Cyanobacteria   | IC <sub>50</sub> | Population growth                    | 240           | LT                    | U (Control survival not reported)   | S                      | 107                | N/S                                             | N/S                                  | N/S                                     | 9.1     | N/S        | Adult                      | Parker et al. (1997)               |
| Cyanophyceae            | <i>Microcystis aeruginosa</i>          | Cyanobacteria   | IC <sub>50</sub> | Population growth                    | 240           | LT                    | U (Control survival not reported)   | S                      | 36                 | 39                                              | N/S                                  | N/S                                     | 8.2     | N/S        | Adult                      | Parker et al. (1997)               |
| Cyanophyceae            | <i>Microcystis aeruginosa</i>          | Cyanobacteria   | IC <sub>50</sub> | Population growth                    | 240           | LT                    | U (Control survival not reported)   | S                      | 249                | N/S                                             | N/S                                  | N/S                                     | 9.1     | N/S        | Adult                      | Parker et al. (1997)               |
| Cyanophyceae            | <i>Nostoc sp.</i>                      | Cyanobacteria   | LOEC             | Population Growth                    | 96            | LT                    | P/S                                 | S                      | 1773               | N/S                                             | N/S                                  | N/S                                     | 8.3     | 25         | Adult                      | Dai et al. (2008)                  |
| Cyanophyceae            | <i>Nostoc sp.</i>                      | Cyanobacteria   | NOEC             | Population Growth                    | 96            | LT                    | P/S                                 | S                      | 355                | N/S                                             | N/S                                  | N/S                                     | 8.3     | 25         | Adult                      | Dai et al. (2008)                  |
| Cyanophyceae            | <i>Synechococcus sp.</i>               | Cyanobacteria   | NOEC             | Population Growth                    | 96            | LT                    | P/S                                 | S                      | 1773               | N/S                                             | N/S                                  | N/S                                     | 8.3     | 25         | Adult                      | Dai et al. (2008)                  |
| Liliopsida (monocots)   | <i>Lemna minor</i>                     | Common duckweed | EC <sub>10</sub> | Growth (# live thalli)               | 168           | LT                    | P/S                                 | N/S                    | 340                | 140                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Simmons (2012)                     |
| Liliopsida (monocots)   | <i>Lemna minor</i>                     | Common duckweed | EC <sub>50</sub> | Growth (# live thalli)               | 168           | LT                    | P/S                                 | N/S                    | 1524               | 140                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Simmons (2012)                     |
| Trebouxiophyceae        | <i>Chlorella vulgaris</i>              | Green algae     | LOEC             | Population Growth                    | 2192-2922     | LT                    | U (Control survival not reported)   | S                      | 319                | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | DeLonge (1965)                     |
| Trebouxiophyceae        | <i>Chlorella vulgaris</i>              | Green algae     | NOEC             | Population Growth                    | 2192-2922     | LT                    | U (Control survival not reported)   | S                      | 285                | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | DeLonge (1965)                     |
| <b>CaCl<sub>2</sub></b> |                                        |                 |                  |                                      |               |                       |                                     |                        |                    |                                                 |                                      |                                         |         |            |                            |                                    |
| Bacillariophyceae       | <i>Nitzschia linearis</i>              | Diatom          | LC <sub>50</sub> | Mortality                            | 120           | Chronic               | ? U (control survival not reported) | S                      | 2000               | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Patrick et al. (1968)              |
| Branchiopoda            | <i>Daphnia magna</i>                   | Water flea      | LC <sub>50</sub> | Mortality                            | 504           | Chronic               | P/S                                 | SR                     | 584                | 45                                              | 42                                   | 9                                       | 7.4-8.2 | 17-19      | 12-24 h old                | Biesinger & Christensen (1972)     |
| Branchiopoda            | <i>Daphnia magna</i>                   | Water flea      | IC <sub>50</sub> | Reproduction                         | 504           | LT                    | P/S                                 | SR                     | 389                | 45                                              | 42                                   | 9                                       | 7.4-8.2 | 17-19      | 12-24 h old                | Biesinger & Christensen (1972)     |
| Branchiopoda            | <i>Daphnia magna</i>                   | Water flea      | IC <sub>16</sub> | Reproduction                         | 504           | LT                    | P/S                                 | SR                     | 205                | 45                                              | 42                                   | 9                                       | 7.4-8.2 | 17-19      | 12-24 h old                | Biesinger & Christensen (1972)     |
| Bacillariophyceae       | <i>Navicula seminulum</i>              | Diatom          | LC <sub>50</sub> | Mortality                            | 96            | LT                    | P/S                                 | S                      | 2000               | 10                                              | N/S                                  | 8                                       | N/S     | 22         | N/S                        | Academy of Natural Sciences (1960) |
| Chlorophyceae           | <i>Pseudokirchneriella subcapitata</i> | Green algae     | EC <sub>10</sub> | Population growth (log cell density) | 96            | LT                    | P/S                                 | N/S                    | 518                | 15                                              | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Simmons (2012)                     |

Table A-1. LONG-TERM/ CHRONIC DATA - NaCl, KCl, CaCl<sub>2</sub>, and MgCl<sub>2</sub> SALTS

| Class                   | Species                                | Common name            | Endpoint          | Endpoint criteria                    | Exp. time (h) | LT (SSD) <sup>A</sup> | Data quality <sup>B</sup>   | Exp. type <sup>C</sup> | Chloride (mg Cl <sup>-</sup> /L) | Hardness <sup>D</sup> (mg CaCO <sub>3</sub> /L) | Alkalinity (mg CaCO <sub>3</sub> /L) | Dissolved oxygen (mg O <sub>2</sub> /L) | pH      | Temp. (°C) | Life stage characteristics | Citation                       |
|-------------------------|----------------------------------------|------------------------|-------------------|--------------------------------------|---------------|-----------------------|-----------------------------|------------------------|----------------------------------|-------------------------------------------------|--------------------------------------|-----------------------------------------|---------|------------|----------------------------|--------------------------------|
| Chlorophyceae           | <i>Pseudokirchneriella subcapitata</i> | Green algae            | EC <sub>10</sub>  | Population growth (fluorescence)     | 96            | LT                    | P/S                         | N/S                    | 177                              | 15                                              | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Simmons (2012)                 |
| Chlorophyceae           | <i>Pseudokirchneriella subcapitata</i> | Green algae            | EC <sub>50</sub>  | Population growth (log cell density) | 96            | LT                    | P/S                         | N/S                    | 993                              | 15                                              | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Simmons (2012)                 |
| Chlorophyceae           | <i>Pseudokirchneriella subcapitata</i> | Green algae            | EC <sub>50</sub>  | Population growth (fluorescence)     | 96            | LT                    | P/S                         | N/S                    | 709                              | 15                                              | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Simmons (2012)                 |
| Gastropoda              | <i>Planorbis cornuus</i>               | Great ramshorn (snail) | EC <sub>50</sub>  | Fecundity (eggs produced)            | 1008          | LT                    | P/S                         | S                      | 769                              | N/S                                             | N/S                                  | N/S                                     | 6.8-7.3 | 22-24      | Adult                      | Mazuran et al. (1999)          |
| Gastropoda              | <i>Planorbis cornuus</i>               | Great ramshorn (snail) | EC <sub>65</sub>  | Fecundity (eggs produced)            | 1008          | LT                    | P/S                         | S                      | 1537                             | N/S                                             | N/S                                  | N/S                                     | 6.8-7.3 | 22-24      | Adult                      | Mazuran et al. (1999)          |
| Gastropoda              | <i>Planorbis cornuus</i>               | Great ramshorn (snail) | EC <sub>45</sub>  | Fecundity (eggs produced)            | 1008          | LT                    | P/S                         | S                      | 3075                             | N/S                                             | N/S                                  | N/S                                     | 6.8-7.3 | 22-24      | Adult                      | Mazuran et al. (1999)          |
| Liliopsida (monocots)   | <i>Lemna minor</i>                     | Common duckweed        | EC <sub>10</sub>  | Growth (# live thalli)               | 168           | LT                    | P/S                         | N/S                    | 482                              | 140                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Simmons (2012)                 |
| Liliopsida (monocots)   | <i>Lemna minor</i>                     | Common duckweed        | EC <sub>50</sub>  | Growth (# live thalli)               | 168           | LT                    | P/S                         | N/S                    | 2056                             | 140                                             | N/S                                  | N/S                                     | N/S     | N/S        | N/S                        | Simmons (2012)                 |
| <b>MgCl<sub>2</sub></b> |                                        |                        |                   |                                      |               |                       |                             |                        |                                  |                                                 |                                      |                                         |         |            |                            |                                |
| Actinopterygii          | <i>Oncorhynchus mykiss</i>             | Rainbow trout          | LC <sub>50</sub>  | Mortality                            | 672           | Chronic               | P/S                         | SR                     | 3952                             | N/S                                             | N/S                                  | >9                                      | 6.9-7.8 | 12.0-13.0  | egg/embryo                 | Birge et al. (1980)            |
| Amphibia                | <i>Bufo americanus</i>                 | American toad          | LC <sub>50</sub>  | Mortality                            | 168           | Chronic               | P/S                         | S                      | 78                               | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | Tadpole                    | Dougherty & Smith (2006)       |
| Amphibia                | <i>Rana clamitans</i>                  | Green frog             | LC <sub>50</sub>  | Mortality                            | 168           | Chronic               | P/S                         | S                      | 86                               | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | Tadpole                    | Dougherty & Smith (2006)       |
| Amphibia                | <i>Xenopus laevis</i>                  | African clawed frog    | LC <sub>50</sub>  | Mortality                            | 168           | Chronic               | U (Tropical species)        | S                      | 169                              | N/S                                             | N/S                                  | N/S                                     | N/S     | N/S        | Tadpole                    | Dougherty & Smith (2006)       |
| Branchiopoda            | <i>Ceriodaphnia reticulata</i>         | Water flea             | IC <sub>100</sub> | Reproduction                         | 360           | LT                    | U (control mortality > 10%) | S                      | 175                              | 48                                              | N/S                                  | N/S                                     | 6.9-7.2 | N/S        | Adult                      | Hutchinson (1933)              |
| Branchiopoda            | <i>Daphnia longispina</i>              | Water flea             | IC <sub>100</sub> | Reproduction                         | 456           | LT                    | U (control mortality > 10%) | S                      | 175                              | 48                                              | N/S                                  | N/S                                     | 6.9-7.2 | N/S        | N/S                        | Hutchinson (1933)              |
| Branchiopoda            | <i>Daphnia longispina</i>              | Water flea             | IC <sub>100</sub> | Reproduction                         | 456           | LT                    | U (control mortality > 10%) | S                      | 88                               | 48                                              | N/S                                  | N/S                                     | 6.9-7.2 | N/S        | N/S                        | Hutchinson (1933)              |
| Branchiopoda            | <i>Daphnia magna</i>                   | Water flea             | LC <sub>50</sub>  | Mortality                            | 504           | Chronic               | P/S                         | SR                     | 564                              | 45                                              | 42                                   | 9                                       | 7.4-8.2 | 17-19      | 12-24 h old                | Biesinger & Christensen (1972) |
| Branchiopoda            | <i>Daphnia magna</i>                   | Water flea             | IC <sub>50</sub>  | Reproduction                         | 504           | LT                    | P/S                         | SR                     | 365                              | 45                                              | 42                                   | 9                                       | 7.4-8.2 | 17-19      | 12-24 h old                | Biesinger & Christensen (1972) |
| Branchiopoda            | <i>Daphnia magna</i>                   | Water flea             | IC <sub>16</sub>  | Reproduction                         | 504           | LT                    | P/S                         | SR                     | 239                              | 45                                              | 42                                   | 9                                       | 7.4-8.2 | 17-19      | 12-24 h old                | Biesinger & Christensen (1972) |
| Branchiopoda            | <i>Daphnia magna</i>                   | Water flea             | IC <sub>100</sub> | Reproduction                         | 456           | LT                    | U (control mortality > 10%) | S                      | 700                              | 48                                              | N/S                                  | N/S                                     | 6.9-7.2 | N/S        | N/S                        | Hutchinson (1933)              |
| Branchiopoda            | <i>Daphnia pulex</i>                   | Water flea             | IC <sub>100</sub> | Reproduction                         | 456           | LT                    | U (control mortality > 10%) | S                      | 350                              | 48                                              | N/S                                  | N/S                                     | 6.9-7.2 | N/S        | N/S                        | Hutchinson (1933)              |

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| Class        | Species                 | Common name | Endpoint criteria | Exp. time (h) | LT (SSD) <sup>A</sup> | Data quality <sup>B</sup>  | Exp. type <sup>C</sup> | Chloride (mg Cl/L) | Hardness <sup>D</sup> (mg CaCO <sub>3</sub> /L) | Alkalinity (mg CaCO <sub>3</sub> /L) | Dissolved oxygen (mg O <sub>2</sub> /L) | pH      | Temp. (°C) | Life stage characteristics | Citation          |
|--------------|-------------------------|-------------|-------------------|---------------|-----------------------|----------------------------|------------------------|--------------------|-------------------------------------------------|--------------------------------------|-----------------------------------------|---------|------------|----------------------------|-------------------|
| Branchiopoda | <i>Daphnia thomsoni</i> | Water flea  | IC <sub>100</sub> | 456           | LT                    | U (control mortality >10%) | S                      | 88                 | 48                                              | N/S                                  | N/S                                     | 6.9-7.2 | N/S        | N/S                        | Hutchinson (1933) |
| Branchiopoda | <i>Moina macrocarpa</i> | Water flea  | IC <sub>100</sub> | 600           | LT                    | U (control mortality >10%) | S                      | 525                | 48                                              | N/S                                  | N/S                                     | 6.9-7.2 | N/S        | Adult                      | Hutchinson (1933) |

<sup>A</sup> **LT (SSD)**: SSD experimental duration requirements for long-term data (CCME 2007). "ST" indicates that the data point meets the requirements for short-term SSD data. "Chronic" indicates that the data is classified as chronic, but does not meet the specific requirements for SSD derivation.

<sup>B</sup> **Data quality**: "P/S" indicates that toxicity data is classified as primary or secondary and can be used in guideline derivation. "U" indicates data points that are deemed unacceptable for guideline derivation. "?" indicates that unclassified data (original document could not be obtained for review).

<sup>C</sup> **Exp. Type**: The type of standard aquatic experiment conducted. "F": flow-through; "P": pulse; "S": static; "SR": static renewal.

<sup>D</sup> **Hardness (mg CaCO<sub>3</sub>/L)**: Hardness is indicated as the permanent hardness (CaCO<sub>3</sub> equivalents). Hardness of the dilution water indicated.

**Notes**: N/S: data not specified; ECx: effect concentration; ICx: inhibitory concentration; LCx: lethal concentration; LOEC: lowest observable effect concentration; MATC: maximum acceptable toxicant concentration; NOEC: no observed effect concentration.

<sup>E</sup> **Specified endpoints**: (1) Survival (gradual increase in NaCl); (2) Decrease in cell number to 43.1% of control (7-d); (3) Decrease in dry matter, photosynthetic pigment and oxygen production; increases in respiration, soluble saccharides and proteins, as well as lipid and proline content (7-d); (4) Negatively effected population density; (5) Negatively effected peak population density; (6) Negatively effected rate of population increase; (7) Negatively effected day of max population density.

**APPENDIX B**

**SUMMARY OF PTAC-SPONSORED TOXICITY TESTING WORK**

**B-1. The University of Georgia Research Foundation (UGARF) 2016(a):  
*Anodonta subangulata*, *Lampsilis siliquoidea*, *Lampsilis fasciola*, and  
*Pimephales promelas* Chloride Toxicity Testing**

Methods for measuring the toxic effect of sodium chloride on mussel glochidia were focused on chronic duration endpoints for use in the derivation of a chronic hardness-dependent chloride aquatic toxicity guidelines. Testing was conducted on three mussel species (*A. subangulata*, *L. siliquoidea*, and *L. fasciola*) and one fish species (*P. promelas*). The species were tested with the following toxicological endpoints measured:

1. 24-hour glochidia functional survival/ viability test for three unionid mussel species;
2. 168-hour survival/ mortality test for one fish species

Target chloride concentrations followed a 0.5 dilution series and included concentrations of 0 (control), 625, 1250, 2500, 5000, and 10000 mg/L NaCl. A control group was tested in association with each set of NaCl treatments for the six reconstituted waters (see description below).

The experiments were conducted in USEPA re-constituted water (with one higher hardness exception) to allow for comparison with other published toxicity testing data and the consistent control of parameters that may relate to toxicity. Below is a table outlining the target ion concentrations of the six reconstituted waters (hardness expressed as CaCO<sub>3</sub>):

| Hardness level | Reconstituted Water | Hardness*               | Na     | K    | Mg   | Ca    | Cl   | SO4   | HCO3  |
|----------------|---------------------|-------------------------|--------|------|------|-------|------|-------|-------|
|                | (type)              | (as CaCO <sub>3</sub> ) | (mg/L) |      |      |       |      |       |       |
| 1              | Very soft; or       | 11                      | 3.3    | 0.3  | 1.5  | 1.7   | 0.2  | 10.2  | 8.7   |
|                | Soft                | 42                      | 13.1   | 1.0  | 6.1  | 7.0   | 1.0  | 40.7  | 34.9  |
| 2              | Moderately hard     | 85                      | 26.3   | 2.1  | 12.1 | 14.0  | 1.9  | 81.4  | 69.7  |
| 3              | Hard                | 169                     | 52.5   | 4.2  | 24.2 | 27.9  | 3.8  | 162.7 | 139.5 |
| 4              | Very hard           | 338                     | 105.1  | 8.4  | 48.5 | 55.9  | 7.6  | 325.4 | 278.9 |
| 5              | Extremely hard      | 677                     | 210.2  | 16.8 | 96.9 | 111.7 | 15.2 | 650.9 | 557.8 |

\* Hardness calculated based on Ca and Mg concentrations ( $2.5[Ca] + 4.1[Mg]$ ).

Chemical analysis of chloride, sulphate, potassium, sodium, calcium, and magnesium ions along with hardness, alkalinity, pH, and conductivity was conducted for each batch of different hardness water and each initial 100% NaCl treatment for each species. Select analytical data and experimental records are summarized in Table B-1.1 through Table B-1.4. Corresponding toxicological endpoints, calculated with BMDS 2.7.0.4. software, and used for the guideline derivation, are present in Figure B-1.1, B-1.2, and B-1.3.

Table B-1.1. Experimental Records for *A. subangulata*

| Water Type     | Measured Hardness (mg/L) | Measured Alkalinity (mg/L) | NaCl (g/L) | Cl (mg/L) | Total Glochidia, # | Total mortality, # | % Mortality | % Survival |
|----------------|--------------------------|----------------------------|------------|-----------|--------------------|--------------------|-------------|------------|
| Soft           | 42                       | 42                         | 0          | 0         | 239                | 25                 | 10.5        | 89.5       |
|                |                          |                            | 0.625      | 379       | 292                | 16                 | 5.5         | 94.5       |
|                |                          |                            | 1.25       | 758       | 219                | 17                 | 7.8         | 92.2       |
|                |                          |                            | 2.5        | 1,517     | 498                | 385                | 77.3        | 22.7       |
|                |                          |                            | 5          | 3,033     | 343                | 343                | 100.0       | 0.0        |
| Medium Hard    | 78                       | 76                         | 10         | 6,066     | 367                | 367                | 100.0       | 0.0        |
|                |                          |                            | 0          | 0         | 199                | 11                 | 5.5         | 94.5       |
|                |                          |                            | 0.625      | 379       | 287                | 7                  | 2.4         | 97.6       |
|                |                          |                            | 1.25       | 758       | 233                | 19                 | 8.2         | 91.8       |
|                |                          |                            | 2.5        | 1,517     | 237                | 193                | 81.4        | 18.6       |
| Hard           | 150                      | 144                        | 5          | 3,033     | 233                | 233                | 100.0       | 0.0        |
|                |                          |                            | 10         | 6,066     | 210                | 210                | 100.0       | 0.0        |
|                |                          |                            | 0          | 0         | 239                | 8                  | 3.3         | 96.7       |
|                |                          |                            | 0.625      | 379       | 342                | 30                 | 8.8         | 91.2       |
|                |                          |                            | 1.25       | 758       | 316                | 14                 | 4.4         | 95.6       |
| Very hard      | 310                      | 278                        | 2.5        | 1,517     | 296                | 86                 | 29.1        | 70.9       |
|                |                          |                            | 5          | 3,033     | 172                | 172                | 100.0       | 0.0        |
|                |                          |                            | 10         | 6,066     | 182                | 182                | 100.0       | 0.0        |
|                |                          |                            | 0          | 0         | 167                | 1                  | 0.6         | 99.4       |
|                |                          |                            | 0.625      | 379       | 246                | 17                 | 6.9         | 93.1       |
| Extremely hard | 548                      | 376                        | 1.25       | 758       | 204                | 13                 | 6.4         | 93.6       |
|                |                          |                            | 2.5        | 1,517     | 182                | 20                 | 11.0        | 89.0       |
|                |                          |                            | 5          | 3,033     | 162                | 53                 | 32.7        | 67.3       |
|                |                          |                            | 10         | 6,066     | 210                | 210                | 100.0       | 0.0        |
|                |                          |                            | 0          | 0         | 224                | 11                 | 4.9         | 95.1       |
|                |                          |                            | 0.625      | 379       | 252                | 18                 | 7.1         | 92.9       |
|                |                          |                            | 1.25       | 758       | 208                | 25                 | 12.0        | 88.0       |
|                |                          |                            | 2.5        | 1,517     | 189                | 27                 | 14.3        | 85.7       |
|                |                          |                            | 5          | 3,033     | 195                | 48                 | 24.6        | 75.4       |
|                |                          |                            | 10         | 6,066     | 178                | 178                | 100.0       | 0.0        |

Table B-1.2. Experimental Records for *L. fasciola*

| Water Type  | Measured Hardness (mg/L) | Measured Alkalinity (mg/L) | NaCl (g/L) | Cl (mg/L) | Total Glochidia, # | Total mortality, # | % Mortality | % Survival |
|-------------|--------------------------|----------------------------|------------|-----------|--------------------|--------------------|-------------|------------|
| Soft        | 44                       | 42                         | 0          | 0         | 374                | 2                  | 0.53        | 99.47      |
|             |                          |                            | 0.625      | 379       | 311                | 7                  | 2.25        | 97.75      |
|             |                          |                            | 1.25       | 758       | 507                | 112                | 22.09       | 77.91      |
|             |                          |                            | 2.5        | 1,517     | 382                | 143                | 37.43       | 62.57      |
|             |                          |                            | 5          | 3,033     | 304                | 304                | 100.00      | 0.00       |
|             |                          |                            | 10         | 6,066     | 430                | 430                | 100.00      | 0.00       |
| Medium Hard | 80                       | 80                         | 0          | 0         | 344                | 0                  | 0.00        | 100.00     |
|             |                          |                            | 0.625      | 379       | 220                | 10                 | 4.55        | 95.45      |
|             |                          |                            | 1.25       | 758       | 338                | 17                 | 5.03        | 94.97      |
|             |                          |                            | 2.5        | 1,517     | 410                | 134                | 32.68       | 67.32      |
|             |                          |                            | 5          | 3,033     | 453                | 289                | 63.80       | 36.20      |
|             |                          |                            | 10         | 6,066     | 265                | 177                | 66.79       | 33.21      |
| Hard        | 188                      | 164                        | 0          | 0         | 205                | 3                  | 1.46        | 98.54      |
|             |                          |                            | 0.625      | 379       | 346                | 0                  | 0.00        | 100.00     |
|             |                          |                            | 1.25       | 758       | 299                | 0                  | 0.00        | 100.00     |
|             |                          |                            | 2.5        | 1,517     | 327                | 5                  | 1.53        | 98.47      |
|             |                          |                            | 5          | 3,033     | 446                | 102                | 22.87       | 77.13      |
|             |                          |                            | 10         | 6,066     | 421                | 421                | 100.00      | 0.00       |
| Very hard   | 324                      | 292                        | 0          | 0         | 353                | 6                  | 1.70        | 98.30      |
|             |                          |                            | 0.625      | 379       | 277                | 1                  | 0.36        | 99.64      |
|             |                          |                            | 1.25       | 758       | 219                | 5                  | 2.28        | 97.72      |
|             |                          |                            | 2.5        | 1,517     | 293                | 30                 | 10.24       | 89.76      |
|             |                          |                            | 5          | 3,033     | 279                | 136                | 48.75       | 51.25      |
|             |                          |                            | 10         | 6,066     | 288                | 288                | 100.00      | 0.00       |

Notes: The extremely hard water conditions for *L. fasciola* were not achieved



Table B-1.3. Experimental Records for *L. siliquioidea*

| Water Type     | Measured Hardness (mg/L) | Measured Alkalinity (mg/L) | NaCl (g/L) | Cl (mg/L) | Total Glochidia, # | Total mortality, # | % Mortality | % Survival |
|----------------|--------------------------|----------------------------|------------|-----------|--------------------|--------------------|-------------|------------|
| Soft           | 42                       | 41                         | 0          | 0         | 374                | 2                  | 0.53        | 99.47      |
|                |                          |                            | 0.625      | 379       | 311                | 7                  | 2.25        | 97.75      |
|                |                          |                            | 1.25       | 758       | 507                | 112                | 22.09       | 77.91      |
|                |                          |                            | 2.5        | 1,517     | 382                | 143                | 37.43       | 62.57      |
|                |                          |                            | 5          | 3,033     | 304                | 304                | 100.00      | 0.00       |
| Medium Hard    | 82                       | 80                         | 10         | 6,066     | 430                | 430                | 100.00      | 0.00       |
|                |                          |                            | 0          | 0         | 344                | 0                  | 0.00        | 100.00     |
|                |                          |                            | 0.625      | 379       | 220                | 10                 | 4.55        | 95.45      |
|                |                          |                            | 1.25       | 758       | 338                | 17                 | 5.03        | 94.97      |
|                |                          |                            | 2.5        | 1,517     | 410                | 134                | 32.68       | 67.32      |
| Hard           | 168                      | 162                        | 5          | 3,033     | 453                | 289                | 63.80       | 36.20      |
|                |                          |                            | 10         | 6,066     | 265                | 177                | 66.79       | 33.21      |
|                |                          |                            | 0          | 0         | 205                | 3                  | 1.46        | 98.54      |
|                |                          |                            | 0.625      | 379       | 346                | 0                  | 0.00        | 100.00     |
|                |                          |                            | 1.25       | 758       | 299                | 0                  | 0.00        | 100.00     |
| Very hard      | 298                      | 280                        | 2.5        | 1,517     | 327                | 5                  | 1.53        | 98.47      |
|                |                          |                            | 5          | 3,033     | 446                | 102                | 22.87       | 77.13      |
|                |                          |                            | 10         | 6,066     | 421                | 421                | 100.00      | 0.00       |
|                |                          |                            | 0          | 0         | 353                | 6                  | 1.70        | 98.30      |
|                |                          |                            | 0.625      | 379       | 277                | 1                  | 0.36        | 99.64      |
| Extremely hard | 464                      | 384                        | 1.25       | 758       | 219                | 5                  | 2.28        | 97.72      |
|                |                          |                            | 2.5        | 1,517     | 293                | 30                 | 10.24       | 89.76      |
|                |                          |                            | 5          | 3,033     | 279                | 136                | 48.75       | 51.25      |
|                |                          |                            | 10         | 6,066     | 288                | 288                | 100.00      | 0.00       |
|                |                          |                            | 0          | 0         | 254                | 4                  | 1.57        | 98.43      |
|                |                          |                            | 0.625      | 379       | 130                | 6                  | 4.62        | 95.38      |
|                |                          |                            | 1.25       | 758       | 241                | 33                 | 13.69       | 86.31      |
|                |                          |                            | 2.5        | 1,517     | 416                | 266                | 63.94       | 36.06      |
|                |                          |                            | 5          | 3,033     | 234                | 176                | 75.21       | 24.79      |
|                |                          |                            | 10         | 6,066     | 224                | 224                | 100.00      | 0.00       |

Table B-1.4. Experimental Records for *P. promelas*

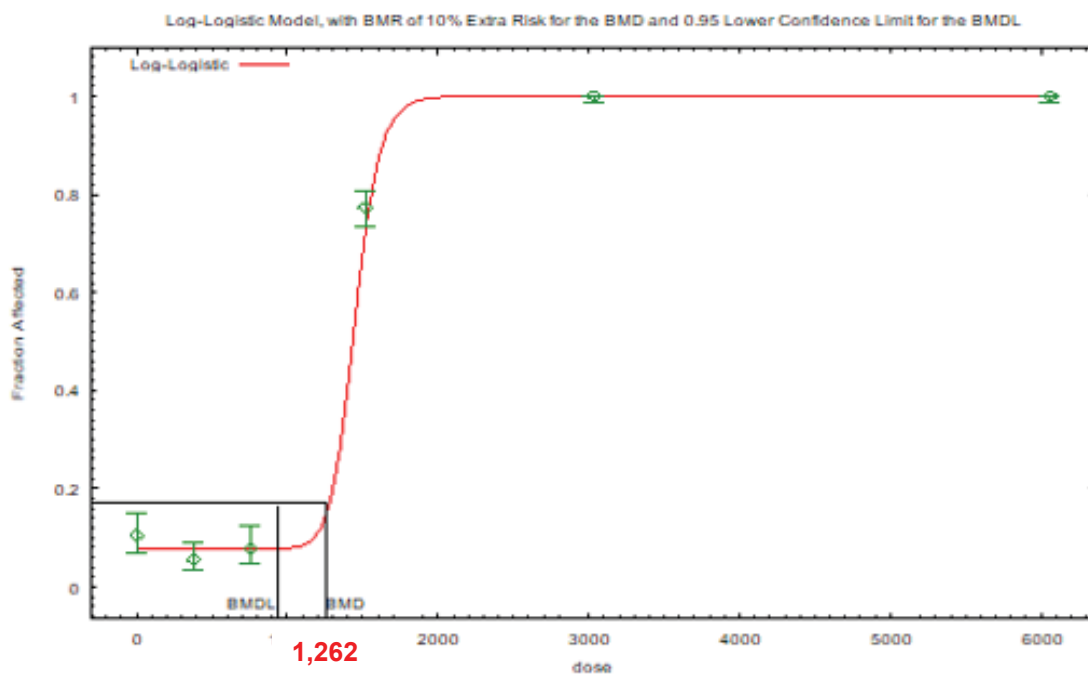
| Water Type     | Measured Hardness (mg/L) | Measured Alkalinity (mg/L) | NaCl (g/L) | Cl (mg/L) | Total fish, # | Total mortality, # | % Mortality | % Survival |
|----------------|--------------------------|----------------------------|------------|-----------|---------------|--------------------|-------------|------------|
| Soft           | 42                       | 42                         | 0          | 0         | 41            | 2                  | 4.9         | 95.1       |
|                |                          |                            | 0.625      | 379       | 41            | 1                  | 2.4         | 97.6       |
|                |                          |                            | 1.25       | 758       | 40            | 1                  | 2.5         | 97.5       |
|                |                          |                            | 2.5        | 1,517     | 40            | 6                  | 15.0        | 85         |
|                |                          |                            | 5          | 3,033     | 40            | 21                 | 52.5        | 47.5       |
|                |                          |                            | 10         | 6,066     | 40            | 40                 | 100.0       | 0          |
| Medium Hard    | 78                       | 76                         | 0          | 0         | 40            | 0                  | 0.0         | 100        |
|                |                          |                            | 0.625      | 379       | 43            | 2                  | 4.7         | 95.3       |
|                |                          |                            | 1.25       | 758       | 40            | 2                  | 5.0         | 95         |
|                |                          |                            | 2.5        | 1,517     | 40            | 3                  | 7.5         | 92.5       |
|                |                          |                            | 5          | 3,033     | 40            | 9                  | 22.5        | 77.5       |
|                |                          |                            | 10         | 6,066     | 40            | 40                 | 100.0       | 0          |
| Hard           | 150                      | 144                        | 0          | 0         | 40            | 2                  | 5.0         | 95         |
|                |                          |                            | 0.625      | 379       | 40            | 3                  | 7.5         | 92.5       |
|                |                          |                            | 1.25       | 758       | 40            | 1                  | 2.5         | 97.5       |
|                |                          |                            | 2.5        | 1,517     | 40            | 2                  | 5.0         | 95         |
|                |                          |                            | 5          | 3,033     | 40            | 18                 | 45.0        | 55         |
|                |                          |                            | 10         | 6,066     | 40            | 40                 | 100.0       | 0          |
| Very hard      | 310                      | 278                        | 0          | 0         | 40            | 2                  | 5.0         | 95         |
|                |                          |                            | 0.625      | 379       | 39            | 1                  | 2.6         | 97.4       |
|                |                          |                            | 1.25       | 758       | 40            | 0                  | 0.0         | 100        |
|                |                          |                            | 2.5        | 1,517     | 39            | 7                  | 17.9        | 82.1       |
|                |                          |                            | 5          | 3,033     | 40            | 27                 | 67.5        | 32.5       |
|                |                          |                            | 10         | 6,066     | 40            | 40                 | 100.0       | 0          |
| Extremely hard | 548                      | 376                        | 0          | 0         | 39            | 1                  | 2.6         | 97.4       |
|                |                          |                            | 0.625      | 379       | 40            | 3                  | 7.5         | 92.5       |
|                |                          |                            | 1.25       | 758       | 41            | 19                 | 46.3        | 53.7       |
|                |                          |                            | 2.5        | 1,517     | 39            | 17                 | 43.6        | 56.4       |
|                |                          |                            | 5          | 3,033     | 41            | 41                 | 100.0       | 0          |
|                |                          |                            | 10         | 6,066     | 40            | 40                 | 100.0       | 0          |

**Figure B-1.1. *Anodonta subangulata* (UGARF, 2016a)  $EC_{10}$  Estimation****a) Soft Water (42 mg  $CaO_3/L$ )****BMDS Input Table: Log-logistic Dichotomous Model**

| Dose  | N   | Effect |
|-------|-----|--------|
| 0     | 239 | 25     |
| 379   | 292 | 16     |
| 758   | 219 | 17     |
| 1,517 | 498 | 385    |
| 3,033 | 343 | 343    |
| 6,066 | 367 | 367    |

Notes:

Dose- Chloride, mg/L; N – number of organisms per dose, effect – number of organisms affected

**BMDS Output Plot:  $EC_{10} = 1,262$  mg/L**

**Figure B-1.1. *Anodonta subangulata* (UGARF, 2016a)  $EC_{10}$  Estimation**

***b) Moderately Hard Water (78 mg CaO<sub>3</sub>/L)***

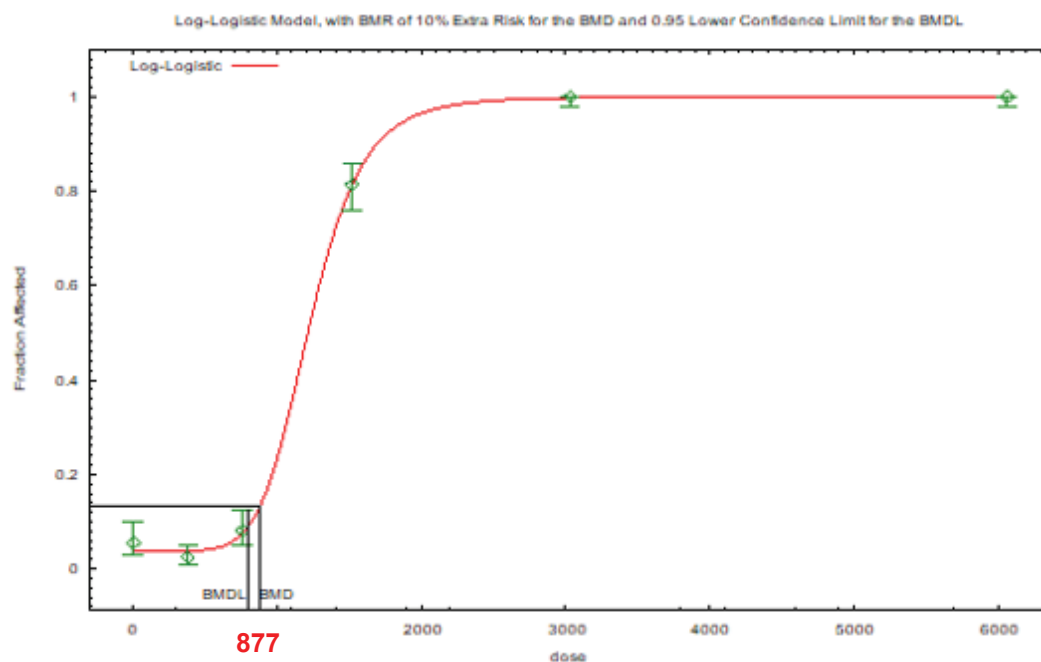
### BMDS Input Table: Log-logistic Dichotomous Model

| Dose  | N   | Effect |
|-------|-----|--------|
| 0     | 199 | 11     |
| 379   | 287 | 7      |
| 758   | 233 | 19     |
| 1,517 | 237 | 193    |
| 3,033 | 233 | 233    |
| 6,066 | 210 | 210    |

Notes:

Dose- Chloride, mg/L; N – number of organisms per dose, effect – number of organisms affected

**BMDS Output Plot: EC<sub>10</sub> = 877 mg/L**



**Figure B-1.1. *Anodonta subangulata* (UGARF, 2016a)  $EC_{10}$  Estimation**

**c) Hard Water (150 mg  $CaO_3/L$ )**

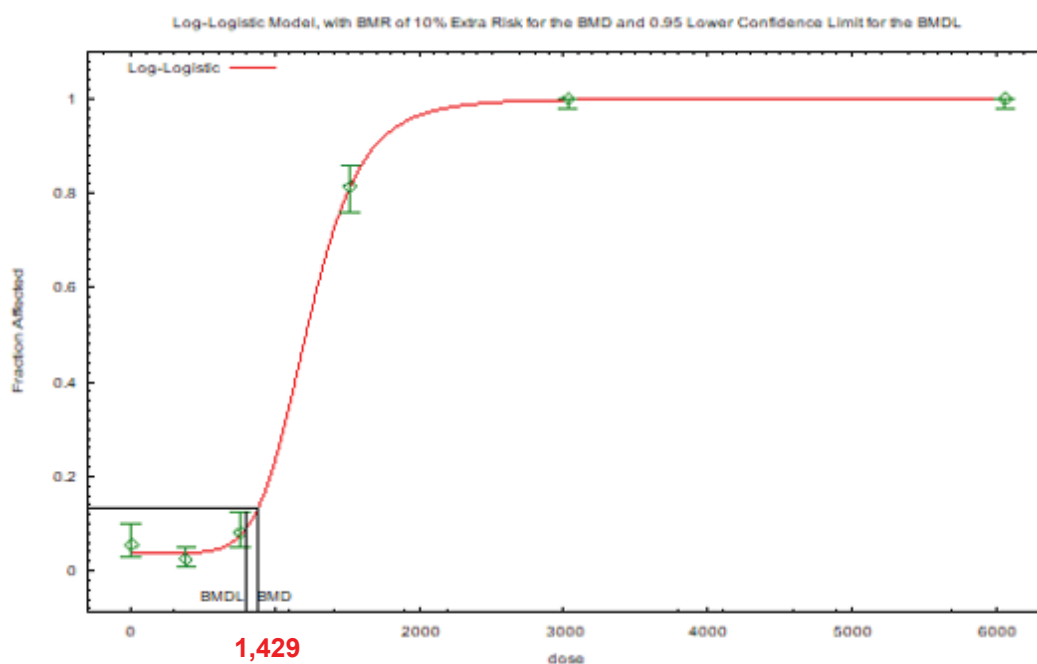
**BMD5 Input Table: Log-logistic Dichotomous Model**

| Dose  | N   | Effect |
|-------|-----|--------|
| 0     | 239 | 8      |
| 379   | 342 | 30     |
| 758   | 316 | 14     |
| 1,517 | 296 | 86     |
| 3,033 | 172 | 172    |
| 6,066 | 182 | 182    |

Notes:

Dose- Chloride, mg/L; N – number of organisms per dose, effect – number of organisms affected

**BMD5 Output Plot:  $EC_{10} = 1,429$  mg/L**



**Figure B-1.1. *Anodonta subangulata* (UGARF, 2016a)  $EC_{10}$  Estimation**

**d) Very Hard Water (310 mg  $CaO_3/L$ )**

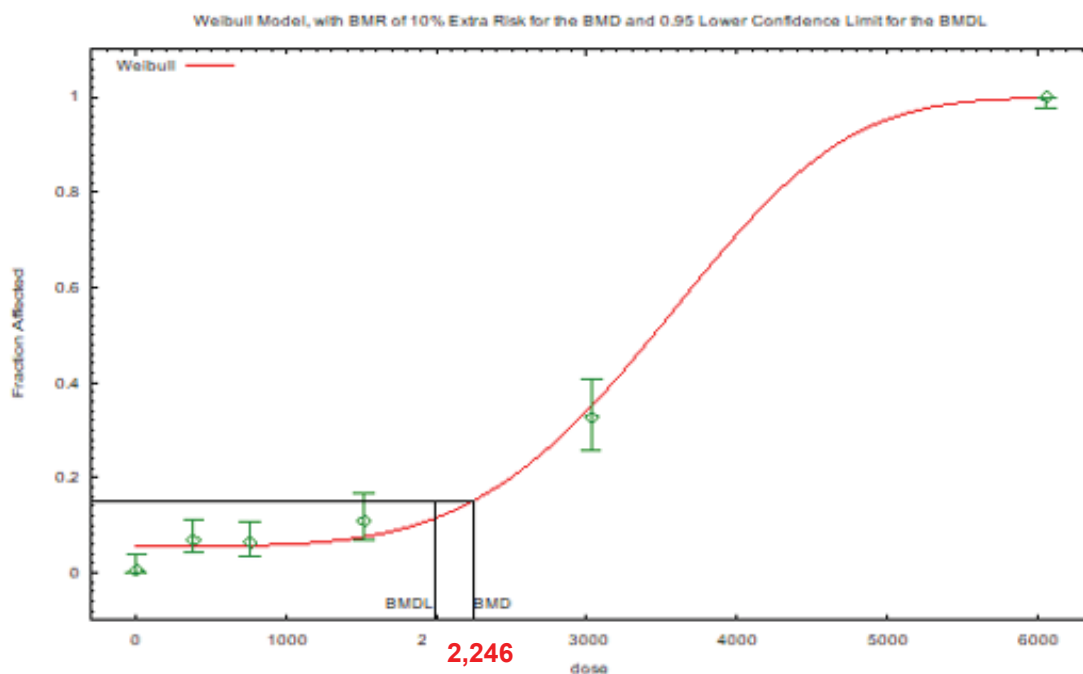
**BMDs Input Table: Weibull Dichotomous Model**

| Dose  | N   | Effect |
|-------|-----|--------|
| 0     | 167 | 1      |
| 379   | 246 | 17     |
| 758   | 204 | 13     |
| 1,517 | 182 | 20     |
| 3,033 | 162 | 53     |
| 6,066 | 210 | 210    |

Notes:

Dose- Chloride, mg/L; N – number of organisms per dose, effect – number of organisms affected

**BMDs Output Plot:  $EC_{10} = 2,246$  mg/L**



**Figure B-1.1. *Anodonta subangulata* (UGARF, 2016a)  $EC_{10}$  Estimation**

**e) Extremely Hard Water (548 mg  $CaO_3/L$ )**

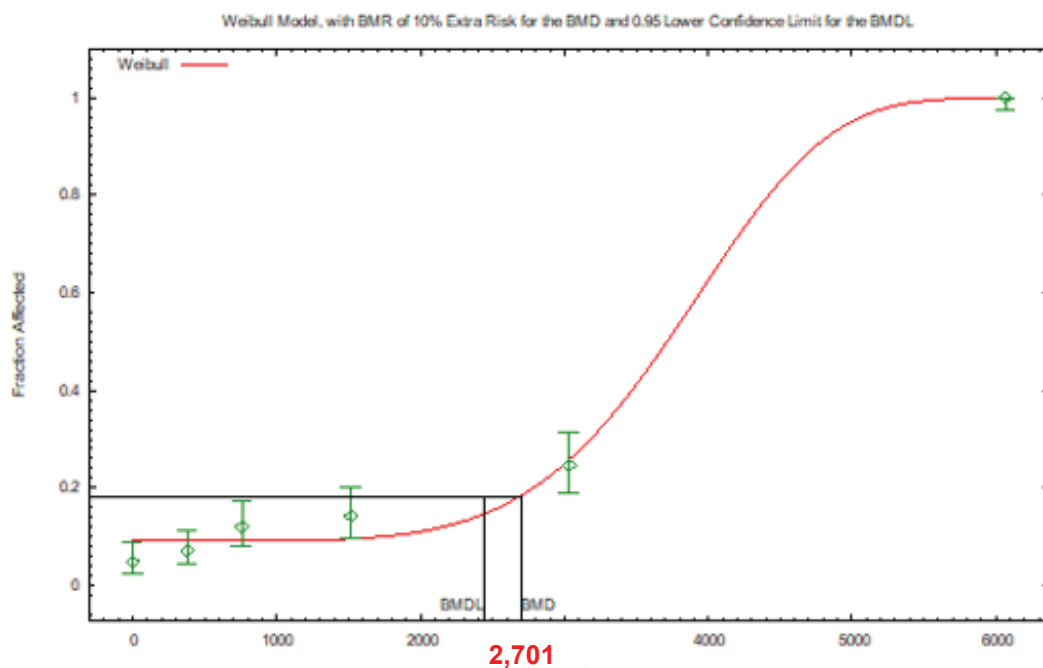
**BMDs Input Table: Weibull Dichotomous Model**

| Dose  | N   | Effect |
|-------|-----|--------|
| 0     | 224 | 11     |
| 379   | 252 | 18     |
| 758   | 208 | 25     |
| 1,517 | 189 | 27     |
| 3,033 | 195 | 48     |
| 6,066 | 178 | 178    |

Notes:

Dose- Chloride, mg/L; N – number of organisms per dose, effect – number of organisms affected

**BMDs Output Plot:  $EC_{10} = 2,701$  mg/L**

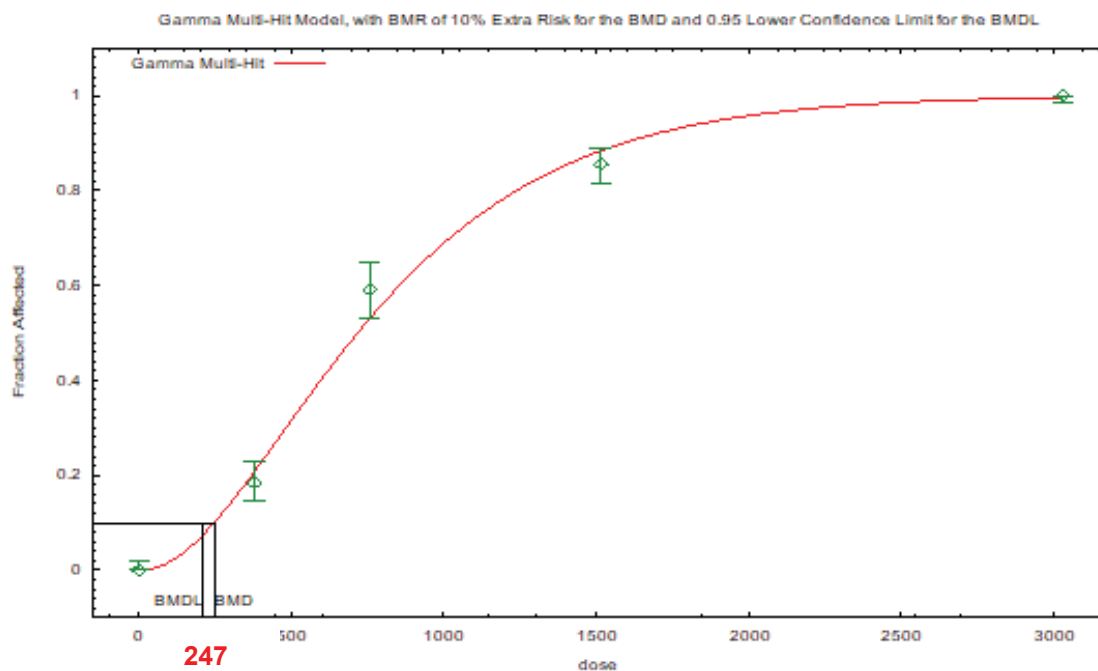


**Figure B-1.2. *Lampsilis fasciola* (UGARF, 2016a)  $EC_{10}$  Estimation****a) Soft Water (44 mg  $CaO_3/L$ )****BMDS Input Table: Gamma Dichotomous Model**

| Dose  | N   | Effect |
|-------|-----|--------|
| 0     | 223 | 0      |
| 379   | 326 | 60     |
| 758   | 296 | 175    |
| 1,517 | 346 | 296    |
| 3,033 | 296 | 296    |

Notes:

Dose- Chloride, mg/L; N – number of organisms per dose, effect – number of organisms affected

**BMDS Output Plot:  $EC_{10} = 247$  mg/L**



**Figure B-1.2. *Lampsilis fasciola* (UGARF, 2016a)  $EC_{10}$  Estimation**

**b) Moderately Hard Water (80 mg  $CaO_3/L$ )**

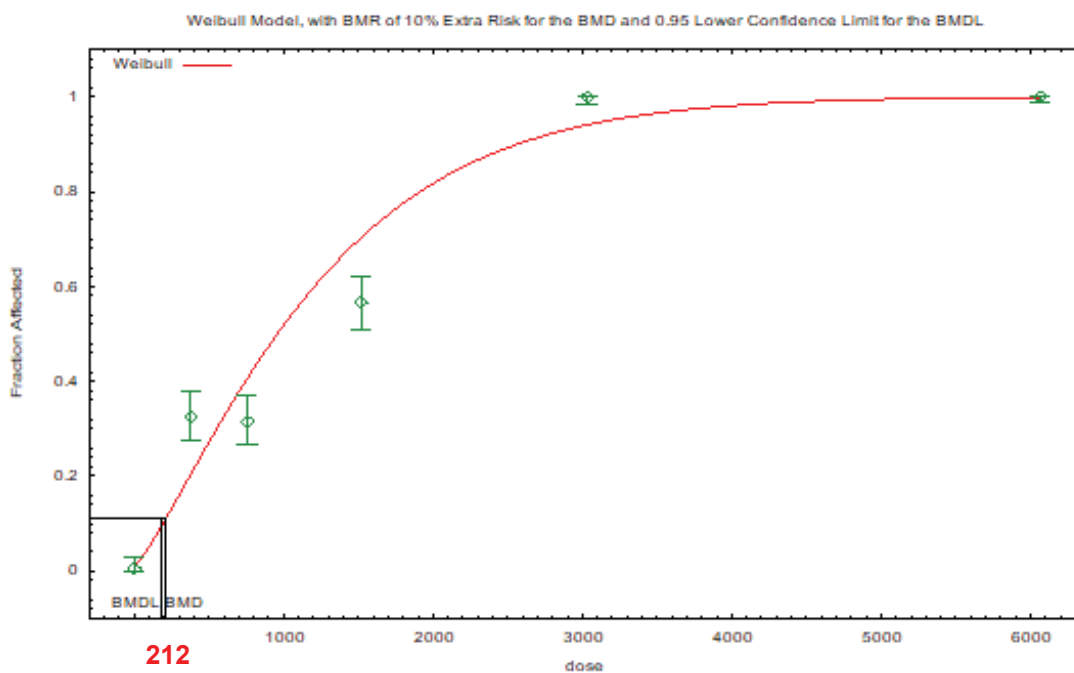
**BMDS Input Table: Weibull Dichotomous Model**

| Dose  | N   | Effect |
|-------|-----|--------|
| 0     | 209 | 1      |
| 379   | 351 | 114    |
| 758   | 317 | 100    |
| 1,517 | 309 | 175    |
| 3,033 | 273 | 273    |
| 6,066 | 397 | 397    |

Notes:

Dose- Chloride, mg/L; N – number of organisms per dose, effect – number of organisms affected

**BMDS Output Plot:  $EC_{10} = 212$  mg/L**

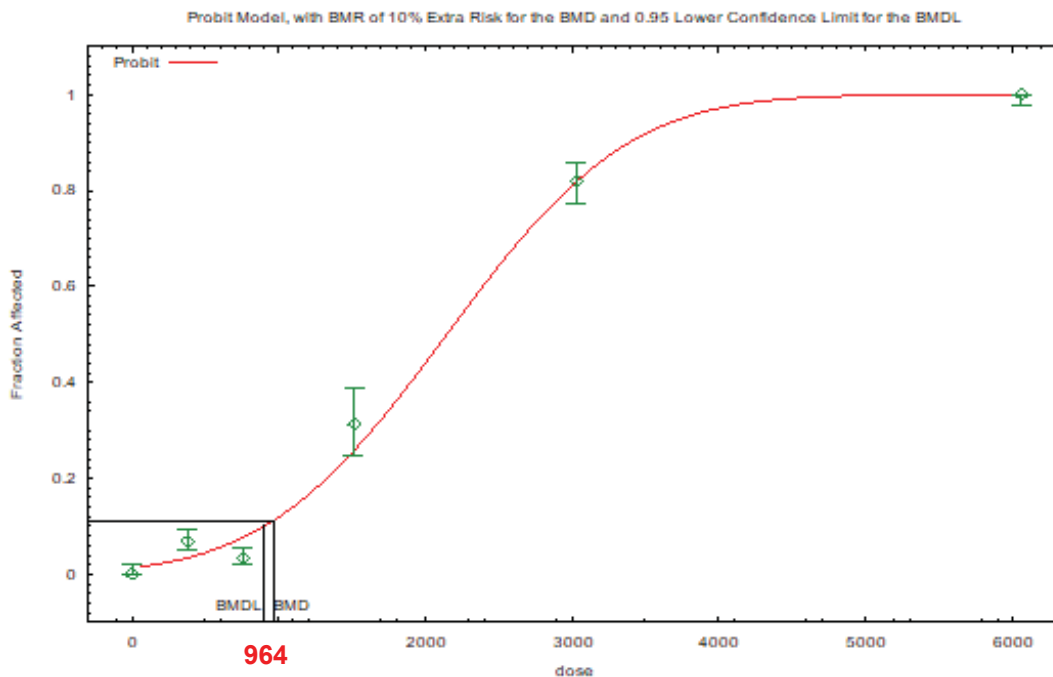


**Figure B-1.2. *Lampsilis fasciola* (UGARF, 2016a)  $EC_{10}$  Estimation****c) Very Hard Water (324 mg  $CaO_3/L$ )****BMDS Input Table: Probit Dichotomous Model**

| Dose  | N   | Effect |
|-------|-----|--------|
| 0     | 231 | 0      |
| 379   | 512 | 35     |
| 758   | 536 | 18     |
| 1,517 | 182 | 57     |
| 3,033 | 339 | 278    |
| 6,066 | 217 | 217    |

Notes:

Dose- Chloride, mg/L; N – number of organisms per dose, effect – number of organisms affected

**BMDS Output Plot:  $EC_{10} = 964$  mg/L**

**Figure B-1.3. *Lampsilis siliquoidea* (UGARF, 2016a)  $EC_{10}$  Estimation**

**a) Soft Water (42 mg  $CaO_3/L$ )**

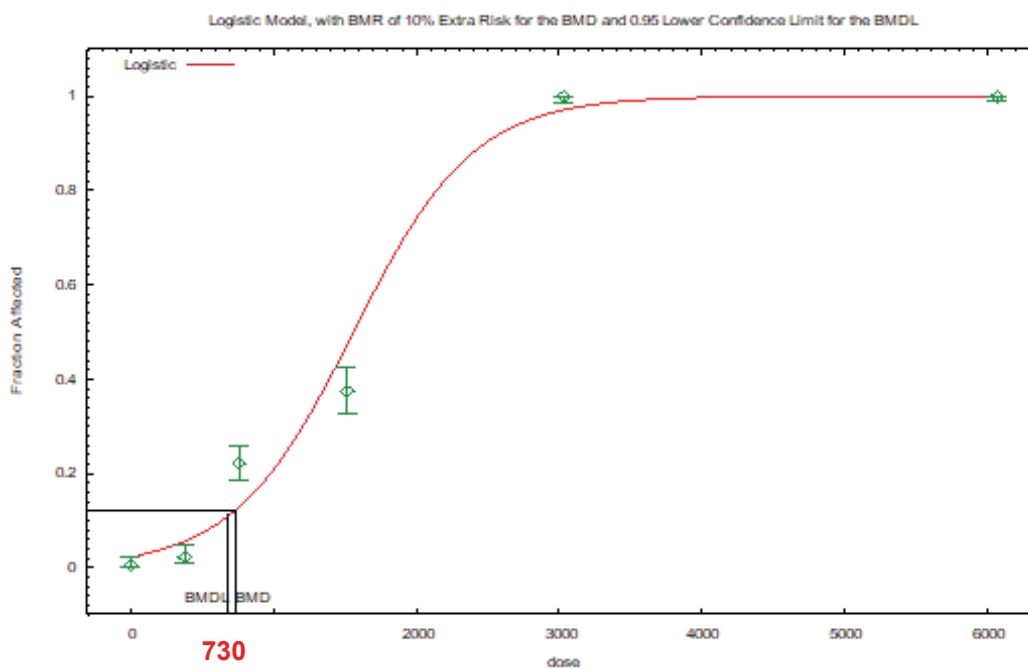
**BMD5 Input Table: Logistic Dichotomous Model**

| Dose  | N   | Effect |
|-------|-----|--------|
| 0     | 374 | 2      |
| 379   | 311 | 7      |
| 758   | 507 | 112    |
| 1,517 | 382 | 143    |
| 3,033 | 304 | 304    |
| 6,066 | 430 | 430    |

Notes:

Dose- Chloride, mg/L; N – number of organisms per dose, effect – number of organisms affected

**BMD5 Output Plot:  $EC_{10} = 730$  mg/L**



**Figure B-1.3. *Lampsilis siligoidea* (UGARF, 2016a)  $EC_{10}$  Estimation**

**b) Moderately Hard Water (82 mg  $CaO_3/L$ )**

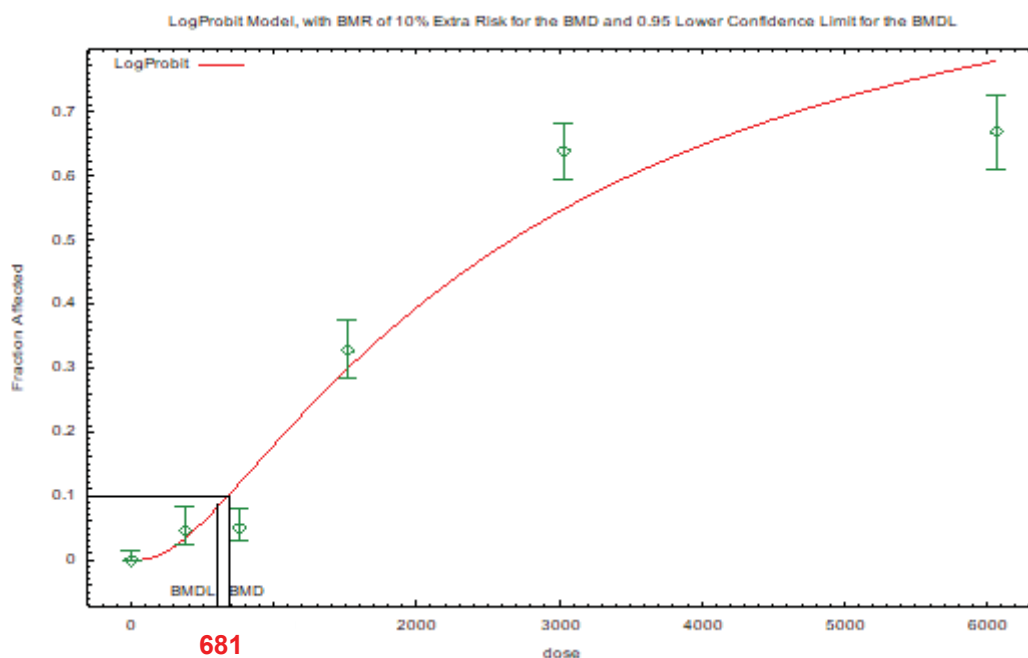
**BMDS Input Table: Log-Probit Dichotomous Model**

| Dose  | N   | Effect |
|-------|-----|--------|
| 0     | 344 | 0      |
| 379   | 220 | 10     |
| 758   | 338 | 17     |
| 1,517 | 410 | 134    |
| 3,033 | 453 | 289    |
| 6,066 | 265 | 177    |

Notes:

Dose- Chloride, mg/L; N – number of organisms per dose, effect – number of organisms affected

**BMDS Output Plot:  $EC_{10} = 681$  mg/L**

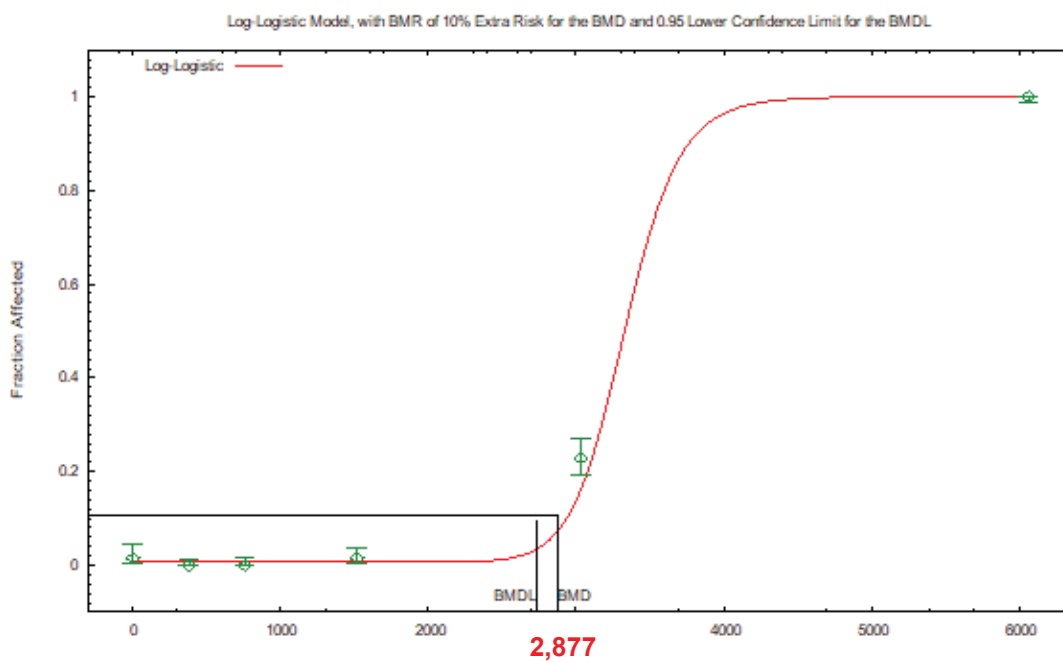


**Figure B-1.3. *Lampsilis siliquoidea* (UGARF, 2016a)  $EC_{10}$  Estimation****c) Hard Water (168 mg  $CaO_3/L$ )****BMDS Input Table: Log-Logistic Dichotomous Model**

| Dose  | N   | Effect |
|-------|-----|--------|
| 0     | 205 | 3      |
| 379   | 346 | 0      |
| 758   | 299 | 0      |
| 1,517 | 327 | 5      |
| 3,033 | 446 | 102    |
| 6,066 | 421 | 421    |

Notes:

Dose- Chloride, mg/L; N – number of organisms per dose, effect – number of organisms affected

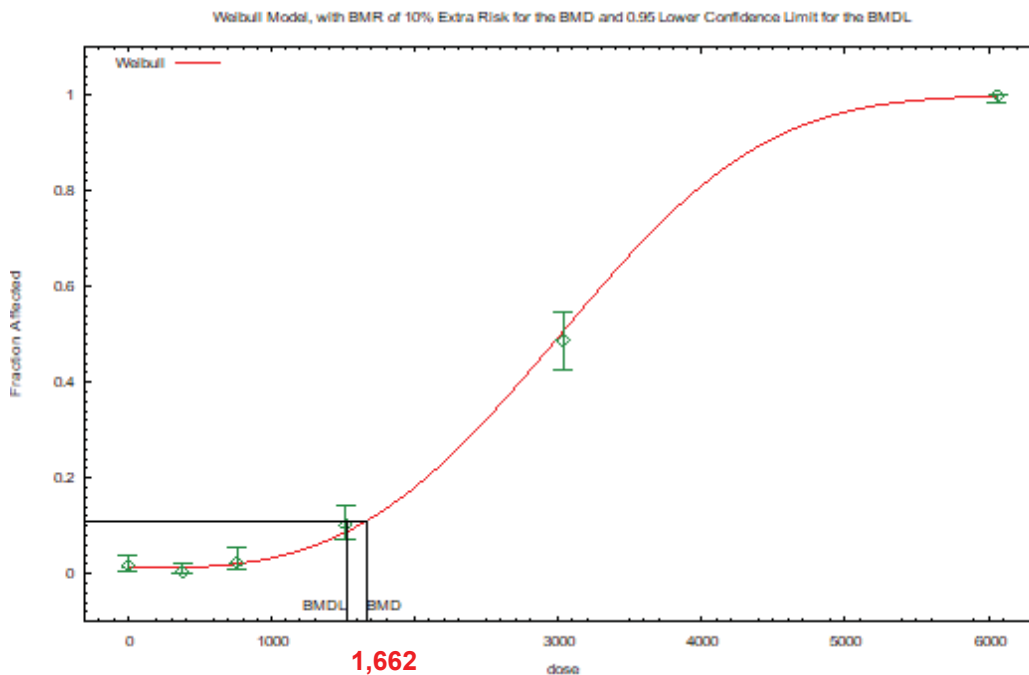
**BMDS Output Plot:  $EC_{10} = 2,877$  mg/L**

**Figure B-1.3. *Lampsilis siliquoidea* (UGARF, 2016a)  $EC_{10}$  Estimation****d) Very Hard Water (298 mg  $CaO_3/L$ )****BMDS Input Table: Logistic Dichotomous Model**

| Dose  | N   | Effect |
|-------|-----|--------|
| 0     | 353 | 6      |
| 379   | 277 | 1      |
| 758   | 219 | 5      |
| 1,517 | 293 | 30     |
| 3,033 | 279 | 136    |
| 6,066 | 288 | 288    |

Notes:

Dose- Chloride, mg/L; N – number of organisms per dose, effect – number of organisms affected

**BMDS Output Plot:  $EC_{10} = 1,662$  mg/L**

**Figure B-1.3. *Lampsilis siliquoidea* (UGARF, 2016a)  $EC_{10}$  Estimation**

**e) Extremely Hard Water (464 mg  $CaO_3/L$ )**

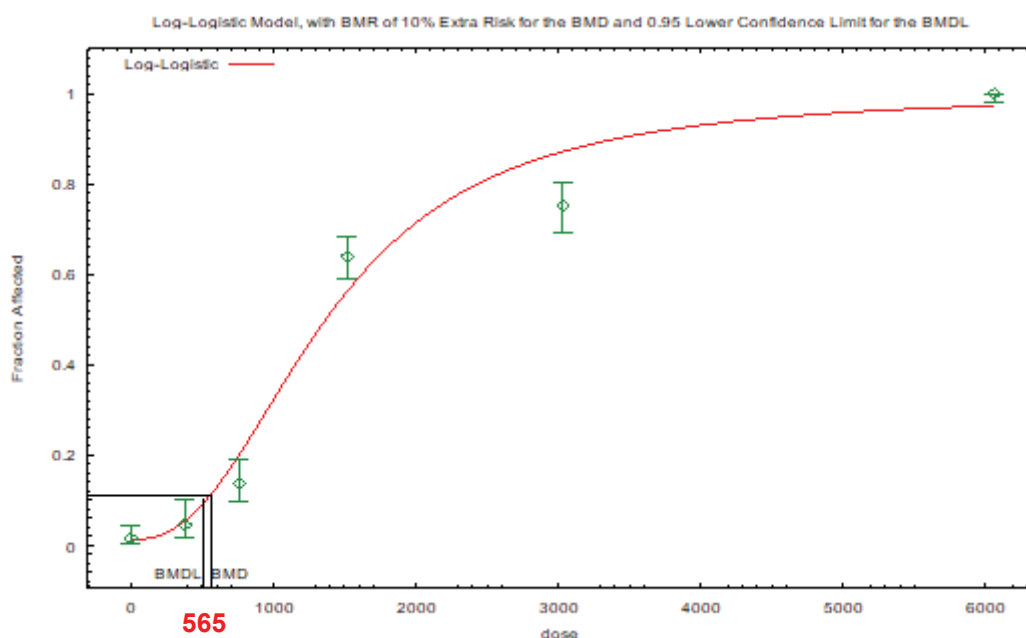
**BMDS Input Table: Log-Logistic Dichotomous Model**

| Dose  | N   | Effect |
|-------|-----|--------|
| 0     | 254 | 4      |
| 379   | 130 | 6      |
| 758   | 241 | 33     |
| 1,517 | 416 | 266    |
| 3,033 | 234 | 176    |
| 6,066 | 224 | 224    |

Notes:

Dose- Chloride, mg/L; N – number of organisms per dose, effect – number of organisms affected

**BMDS Output Plot:  $EC_{10} = 565$  mg/L**



Notes:

The calculated value of 565 mg/L was not used in the final SSD, due to potential toxicological interference in extremely hard waters. Such interference suggested that ameliorating effect of hardness may drop with increasing salt concentrations (discussed in the main text).

## B-2. The University of Georgia Research Foundation (UGARF) 2016(b): *Lampsilis siliquoidea* Multi-Salt Toxicity Testing

The primary objective of this work was to establish toxicological relationships between commonly occurring salt ions in natural aquatic environments, namely  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{Cl}^-$ ,  $\text{SO}_4^{2-}$ , and  $\text{HCO}_3^-$ . The toxicity of the various combinations of these ions in the moderately hard water (water hardness of 100 mg  $\text{CaCO}_3$  mg/L) was examined using the unionid mussel *L. siliquoidea*, 24-hour glochidia functional survival/ viability test.

Calculated toxicity values on the whole salt basis are summarized in Table B-2.1, and calculated toxicity values on the anion basis are shown in Table B-2.1.

**Table B-2.1. *L. siliquoidea* Toxicity Endpoint Summary: Whole Salt Basis**

| Salt                            | LC <sub>50</sub> | LCI    | UCI    |
|---------------------------------|------------------|--------|--------|
| NaCl                            | 4.04             | 3.57   | 4.51   |
| MgCl <sub>2</sub>               | 2.801            | 2.543  | 3.059  |
| CaCl <sub>2</sub>               | 3.286            | 2.599  | 3.974  |
| KCl                             | 0.0102           | 0.0097 | 0.0107 |
| Na <sub>2</sub> SO <sub>4</sub> | 2.195            | 2.033  | 2.357  |
| MgSO <sub>4</sub>               | 0.492            | 0.389  | 0.595  |
| CaSO <sub>4</sub>               | 0.293            | 0.27   | 0.316  |
| NaHCO <sub>3</sub>              | 2.713            | 2.449  | 2.976  |

LCI – Lower Confidence Interval

UCI – Upper Confidence Interval

**Table B-2.2. *L. siliquoidea* Toxicity Endpoint Summary: Anion Basis**

| Salt                            | LC <sub>50</sub> | LCI     | UCI     |
|---------------------------------|------------------|---------|---------|
| NaCl                            | 2.462            | 2.168   | 2.755   |
| MgCl <sub>2</sub>               | 1.845            | 1.683   | 2.006   |
| CaCl <sub>2</sub>               | 2.103            | 1.663   | 2.543   |
| KCl                             | 0.0049           | 0.00465 | 0.00516 |
| Na <sub>2</sub> SO <sub>4</sub> | 1.492            | 1.382   | 1.604   |
| MgSO <sub>4</sub>               | 0.394            | 0.312   | 0.476   |
| CaSO <sub>4</sub>               | 0.209            | 0.19    | 0.229   |
| NaHCO <sub>3</sub>              | 1.984            | 1.792   | 2.176   |

LCI – Lower Confidence Interval

UCI – Upper Confidence Interval



### **B-3. Wisconsin State Laboratory of Hygiene (WSLH) 2016: *Ceriodaphnia dubia* and *Pseudokirchneriella subcapitata* Chloride Toxicity Testing**

In 2016, WSLH conducted a sodium chloride toxicity study at six different hardness levels, ranging from the very soft water (10 mg/L) to extremely hard water (576 mg/L). The *C. dubia* (water flea) and *P. subcapitata* (microalgae) were tested for key toxicological endpoints.

*C. dubia* tests were 168 hours static-renewal chronic tests assessing mortality and reproduction. *P. subcapitata* static tests lasted 96 hours and assessed growth. The experimental records for *P. subcapitata* are shown in Table B-3.1. The experimental records for *C. dubia* are shown in Table B-3.2. Corresponding toxicological endpoints, calculated with BMDS 2.7.0.4. software, and used for the guideline derivation, are present in Figure B-3.1 and B.3.2.

Table B-3.1. *C.dubia* Survival and Reproduction Test Summary

| Water Type                                           | NaCl (g/L) | Neonate Reproduction by Replicate |    |    |    |    |    |    |    |    |    | Mean Neonates | % Adult Survival | SD |
|------------------------------------------------------|------------|-----------------------------------|----|----|----|----|----|----|----|----|----|---------------|------------------|----|
|                                                      |            | 1                                 | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 |               |                  |    |
| Very Soft Water<br>(11 mg CaO <sub>3</sub> /L)       | 0          | 29                                | 22 | 35 | 32 | 26 | 26 | 26 | 24 | 30 | 27 | 28            | 100              | 4  |
|                                                      | 0.078      | 19                                | 26 | 28 | 29 | 25 | 6  | 31 | 21 | 26 | 26 | 24            | 100              | 7  |
|                                                      | 0.156      | 18                                | 26 | 30 | 21 | 22 | 18 | 24 | 19 | 14 | 25 | 22            | 100              | 5  |
|                                                      | 0.313      | 20                                | 22 | 14 | 8  | 16 | 12 | 1  | 19 | 20 | 17 | 15            | 90               | 6  |
|                                                      | 0.625      | 0                                 | 0  | 8  | 11 | 4  | 0  | 9  | 0  | 0  | 0  | 3             | 50               | 4  |
|                                                      | 1.25       | 0                                 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0             | 0                | 0  |
|                                                      | 2.5        | 0                                 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0             | 0                | 0  |
| Soft water<br>(44 mg CaO <sub>3</sub> /L)            | 0          | 28                                | 31 | 24 | 33 | 21 | 35 | 38 | 30 | 31 | 34 | 31            | 90               | 5  |
|                                                      | 0.078      | 41                                | 31 | 31 | 31 | 36 | 35 | 33 | 35 | 32 | 31 | 34            | 100              | 3  |
|                                                      | 0.156      | 29                                | 31 | 22 | 29 | 21 | 24 | 24 | 26 | 29 | 34 | 27            | 90               | 4  |
|                                                      | 0.313      | 29                                | 23 | 38 | 33 | 33 | 34 | 26 | 29 | 32 | 30 | 31            | 100              | 4  |
|                                                      | 0.625      | 29                                | 32 | 33 | 23 | 23 | 3  | 25 | 18 | 21 | 26 | 23            | 80               | 9  |
|                                                      | 1.25       | 19                                | 20 | 6  | 19 | 13 | 9  | 7  | 17 | 0  | 12 | 12            | 90               | 7  |
|                                                      | 2.5        | 0                                 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0             | 0                | 0  |
| Moderately Hard Water<br>(89 mg CaO <sub>3</sub> /L) | 0          | 30                                | 28 | 25 | 25 | 22 | 31 | 31 | 27 | 30 | 12 | 26            | 100              | 6  |
|                                                      | 0.078      | 35                                | 32 | 25 | 30 | 28 | 26 | 34 | 28 | 27 | 27 | 29            | 100              | 3  |
|                                                      | 0.156      | 27                                | 32 | 30 | 27 | 31 | 27 | 29 | 32 | 28 | 29 | 29            | 100              | 2  |
|                                                      | 0.313      | 20                                | 30 | 28 | 19 | 26 | 15 | 30 | 30 | 28 | 23 | 25            | 100              | 5  |
|                                                      | 0.625      | 22                                | 3  | 22 | 29 | 30 | 24 | 24 | 22 | 29 | 25 | 23            | 90               | 8  |
|                                                      | 1.25       | 17                                | 8  | 0  | 4  | 9  | 13 | 17 | 16 | 6  | 14 | 10            | 90               | 6  |
|                                                      | 2.5        | 0                                 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0             | 0                | 0  |
| Hard Water<br>(173 mg CaO <sub>3</sub> /L)           | 0          | 32                                | 25 | 34 | 34 | 32 | 25 | 26 | 28 | 39 | 27 | 30            | 100              | 5  |
|                                                      | 0.078      | 15                                | 29 | 35 | 32 | 34 | 30 | 6  | 29 | 35 | 28 | 27            | 90               | 9  |
|                                                      | 0.156      | 37                                | 28 | 33 | 33 | 32 | 32 | 32 | 31 | 34 | 30 | 32            | 100              | 2  |
|                                                      | 0.313      | 37                                | 29 | 28 | 31 | 31 | 29 | 28 | 31 | 34 | 31 | 31            | 100              | 3  |
| Hard Water<br>(173 mg CaO <sub>3</sub> /L)           | 0.625      | 30                                | 17 | 28 | 31 | 30 | 30 | 21 | 31 | 30 | 28 | 28            | 90               | 5  |

Table B-3.1. *C.dubia* Survival and Reproduction Test Summary

| Water Type                                                               | NaCl (g/L) | Neonate Reproduction by Replicate |    |    |    |    |    |    |    |    |    | Mean Neonates | % Adult Survival | SD |
|--------------------------------------------------------------------------|------------|-----------------------------------|----|----|----|----|----|----|----|----|----|---------------|------------------|----|
|                                                                          |            | 1                                 | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 |               |                  |    |
| Very Hard Water<br>(350 mg CaO <sub>3</sub> /L)                          | 1.25       | 23                                | 23 | 28 | 10 | 21 | 23 | 21 | 16 | 23 | 23 | 21            | 100              | 5  |
|                                                                          | 2.5        | 0                                 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0             | 0                | 0  |
|                                                                          | 0          | 23                                | 28 | 25 | 21 | 22 | 26 | 29 | 29 | 23 | 1  | 23            | 100              | 8  |
|                                                                          | 0.078      | 25                                | 22 | 21 | 27 | 26 | 23 | 29 | 24 | 25 | 22 | 24            | 100              | 3  |
|                                                                          | 0.156      | 23                                | 27 | 28 | 23 | 22 | 22 | 24 | 21 | 19 | 8  | 22            | 100              | 5  |
|                                                                          | 0.313      | 27                                | 23 | 27 | 26 | 24 | 23 | 26 | 27 | 26 | 23 | 25            | 100              | 2  |
|                                                                          | 0.625      | 22                                | 22 | 26 | 24 | 23 | 18 | 23 | 19 | 27 | 22 | 23            | 100              | 3  |
|                                                                          | 1.25       | 18                                | 20 | 23 | 22 | 3  | 18 | 17 | 15 | 0  | 8  | 14            | 90               | 8  |
| Extremely Hard<br>Water<br>(576 mg CaO <sub>3</sub> /L) – 1 <sup>B</sup> | 2.5        | 0                                 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0             | 0                | 0  |
|                                                                          | 0          | 28                                | 25 | 25 | 26 | 24 | 19 | 0  | 23 | 16 | 28 | 21            | 90               | 8  |
|                                                                          | 0.078      | 20                                | 19 | 21 | 24 | 23 | 21 | 0  | 23 | 23 | 19 | 19            | 90               | 7  |
|                                                                          | 0.156      | LA <sup>C</sup>                   | 2  | 24 | 25 | 21 | 17 | 25 | 0  | 26 | 20 | 18            | 78               | 10 |
|                                                                          | 0.313      | 22                                | 0  | 16 | 25 | 14 | 18 | 25 | 4  | 25 | 20 | 17            | 90               | 9  |
|                                                                          | 0.625      | 0                                 | 10 | 0  | 19 | 22 | 20 | 16 | 4  | 0  | 0  | 9             | 60               | 9  |
|                                                                          | 1.25       | 4                                 | 16 | 15 | 2  | 0  | 9  | 10 | 0  | 0  | 12 | 7             | 70               | 6  |
|                                                                          | 2.5        | 0                                 | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0             | 10               | 0  |
| Extremely Hard<br>Water<br>(576 mg CaO <sub>3</sub> /L) – 2 <sup>B</sup> | 0          | 30                                | 37 | 30 | 32 | 40 | 0  | 33 | 38 | 33 | 30 | 30            | 90               | 11 |
|                                                                          | 0.078      | 35                                | 0  | 31 | 34 | 29 | 38 | 29 | 34 | 30 | 33 | 29            | 90               | 11 |
|                                                                          | 0.156      | 34                                | 0  | 14 | 23 | 38 | 33 | 27 | 35 | 34 | 33 | 27            | 90               | 12 |
|                                                                          | 0.313      | 27                                | 32 | 30 | 30 | 37 | 33 | 28 | 31 | 30 | 32 | 31            | 100              | 3  |
|                                                                          | 0.625      | 28                                | 33 | 26 | 24 | 24 | 0  | 27 | 31 | 25 | 28 | 25            | 90               | 9  |
|                                                                          | 1.25       | 0                                 | 0  | 23 | 0  | 27 | 0  | 22 | 23 | 21 | 23 | 14            | 70               | 12 |
|                                                                          | 2.5        | 0                                 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0             | 30               | 0  |
|                                                                          |            |                                   |    |    |    |    |    |    |    |    |    |               |                  |    |

**SD** – Standard deviation

**1<sup>B</sup>, 2<sup>B</sup>**: Both extremely hard water (EHW 1 and EHW 2) tests met test acceptability criteria. However, EHW 1 had high variability in mortality and reproduction, so the test was conducted again and both sets of results are provided. Note, that the extremely hard water values were not included in the *C. dubia* final dataset, due to potential toxicity interference.

Table B-3.2. *P. subcapitata* Growth Test Summary

| Water Type                                              | NaCl (g/L) | Growth Measurement per Replicate<br>(Fluorescence Reading Minus Blank) |     |     |     | Mean Growth | SD |
|---------------------------------------------------------|------------|------------------------------------------------------------------------|-----|-----|-----|-------------|----|
|                                                         |            | 1                                                                      | 2   | 3   | 4   |             |    |
| Very Soft Water<br>(11 mg CaO <sub>3</sub> /L)          | 0          | 590                                                                    | 629 | 607 | 641 | 617         | 23 |
|                                                         | 0.16       | 647                                                                    | 623 | 682 | 608 | 640         | 32 |
|                                                         | 0.32       | 652                                                                    | 605 | 653 | 626 | 634         | 23 |
|                                                         | 0.63       | 583                                                                    | 559 | 572 | 643 | 589         | 37 |
|                                                         | 1.25       | 511                                                                    | 498 | 487 | 475 | 493         | 15 |
|                                                         | 2.5        | 360                                                                    | 335 | 340 | 338 | 343         | 11 |
|                                                         | 5          | 65                                                                     | 61  | 64  | 62  | 63          | 2  |
| Soft water<br>(44 mg CaO <sub>3</sub> /L)               | 10         | 3                                                                      | 2   | 8   | 2   | 4           | 3  |
|                                                         | 0          | 689                                                                    | 675 | 692 | 691 | 687         | 8  |
|                                                         | 0.16       | 671                                                                    | 685 | 667 | 696 | 680         | 13 |
|                                                         | 0.32       | 682                                                                    | 658 | 656 | 646 | 661         | 15 |
|                                                         | 0.63       | 668                                                                    | 647 | 668 | 683 | 667         | 15 |
|                                                         | 1.25       | 613                                                                    | 619 | 614 | 623 | 617         | 5  |
|                                                         | 2.5        | 545                                                                    | 506 | 487 | 507 | 511         | 24 |
| Moderately Hard<br>Water<br>(89 mg CaO <sub>3</sub> /L) | 5          | 127                                                                    | 114 | 128 | 132 | 125         | 8  |
|                                                         | 10         | 11                                                                     | 7   | 7   | 8   | 8           | 2  |
|                                                         | 0          | 590                                                                    | 590 | 613 | 612 | 601         | 13 |
|                                                         | 0.16       | 621                                                                    | 623 | 649 | 627 | 630         | 13 |
|                                                         | 0.32       | 617                                                                    | 598 | 627 | 617 | 615         | 12 |
|                                                         | 0.63       | 561                                                                    | 581 | 584 | 633 | 590         | 31 |
|                                                         | 1.25       | 535                                                                    | 520 | 556 | 570 | 545         | 22 |
| Hard Water<br>(173 mg CaO <sub>3</sub> /L)              | 2.5        | 463                                                                    | 460 | 489 | 494 | 477         | 17 |
|                                                         | 5          | 139                                                                    | 136 | 151 | 147 | 143         | 7  |
|                                                         | 10         | 7                                                                      | 7   | 7   | 6   | 7           | 1  |
|                                                         | 0          | 663                                                                    | 682 | 670 | 680 | 674         | 9  |
|                                                         | 0.16       | 665                                                                    | 683 | 673 | 684 | 676         | 9  |

Table B-3.2. *P. subcapitata* Growth Test Summary

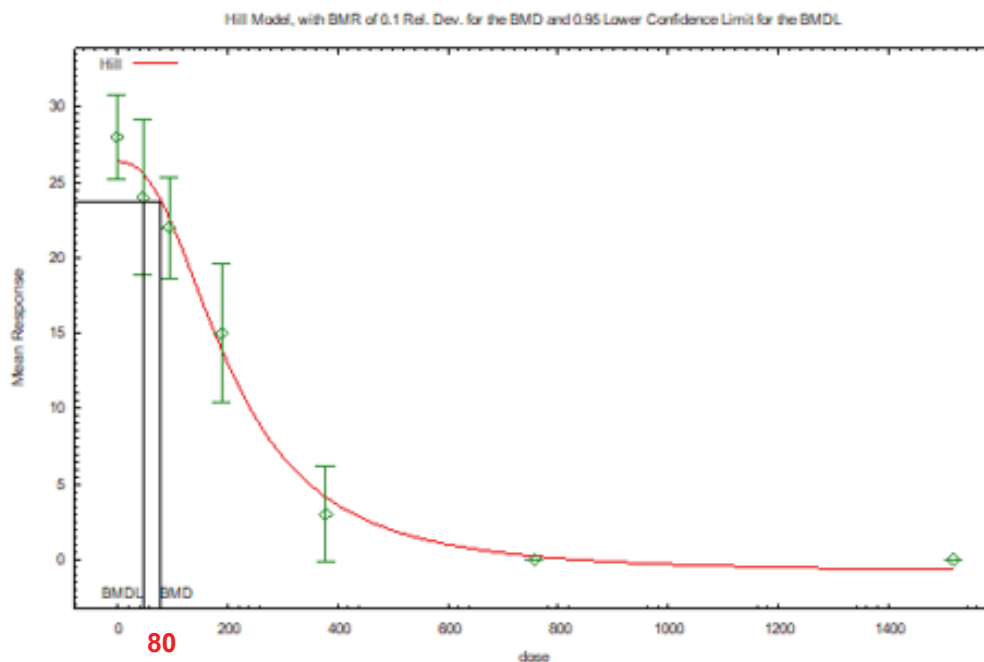
| Water Type                                              | NaCl (g/L) | Growth Measurement per Replicate<br>(Fluorescence Reading Minus Blank) |     |     |     | Mean Growth | SD |
|---------------------------------------------------------|------------|------------------------------------------------------------------------|-----|-----|-----|-------------|----|
|                                                         |            | 1                                                                      | 2   | 3   | 4   |             |    |
| Hard Water<br>(173 mg CaO <sub>3</sub> /L)              | 0.32       | 657                                                                    | 669 | 677 | 665 | 667         | 8  |
|                                                         | 0.63       | 663                                                                    | 675 | 682 | 689 | 677         | 11 |
|                                                         | 1.25       | 660                                                                    | 641 | 632 | 635 | 642         | 13 |
|                                                         | 2.5        | 592                                                                    | 593 | 587 | 612 | 596         | 11 |
|                                                         | 5          | 241                                                                    | 213 | 224 | 236 | 229         | 13 |
| Very Hard Water<br>(350 mg CaO <sub>3</sub> /L)         | 10         | 7                                                                      | 9   | 9   | 9   | 9           | 1  |
|                                                         | 0          | 594                                                                    | 605 | 605 | 594 | 600         | 6  |
|                                                         | 0.16       | 599                                                                    | 606 | 611 | 603 | 605         | 5  |
|                                                         | 0.32       | 586                                                                    | 602 | 599 | 607 | 599         | 9  |
|                                                         | 0.63       | 585                                                                    | 600 | 598 | 581 | 591         | 9  |
| Extremely Hard<br>Water<br>(576 mg CaO <sub>3</sub> /L) | 1.25       | 553                                                                    | 576 | 575 | 568 | 568         | 11 |
|                                                         | 2.5        | 500                                                                    | 544 | 524 | 517 | 521         | 18 |
|                                                         | 5          | 236                                                                    | 262 | 295 | 287 | 270         | 27 |
|                                                         | 10         | 18                                                                     | 15  | 11  | 11  | 14          | 3  |
|                                                         | 0          | 564                                                                    | 559 | 572 | 561 | 564         | 6  |
| <i>SD – Standard deviation</i>                          | 0.16       | 579                                                                    | 561 | 580 | 569 | 572         | 9  |
|                                                         | 0.32       | 577                                                                    | 559 | 543 | 545 | 556         | 16 |
|                                                         | 0.63       | 550                                                                    | 543 | 525 | 581 | 550         | 23 |
|                                                         | 1.25       | 545                                                                    | 547 | 537 | 542 | 543         | 4  |
|                                                         | 2.5        | 509                                                                    | 516 | 500 | 502 | 507         | 7  |
|                                                         | 5          | 239                                                                    | 265 | 275 | 277 | 264         | 17 |
|                                                         | 10         | 9                                                                      | 7   | 8   | 8   | 8           | 1  |

**Figure B-3.1. *Ceriodaphnia dubia* (WSLH, 2016)  $EC_{10}$  Estimation****a) Very Soft Water (11 mg  $CaO_3/L$ )****BMDS Input Table: Hill Continuous Model**

| Cl, mg/L | N  | Neonates | St. Dev. |
|----------|----|----------|----------|
| 0        | 10 | 28       | 3.86     |
| 47       | 10 | 24       | 7.15     |
| 95       | 10 | 22       | 4.69     |
| 190      | 10 | 15       | 6.45     |
| 379      | 10 | 3        | 4.47     |
| 758      | 10 | 0        | 0        |
| 1517     | 10 | 0        | 0        |

Notes:

Dose was entered as chloride concentration (mg/L); N -replicate number; neonates – number of juveniles in the end of the test; st.dev. – standard deviation

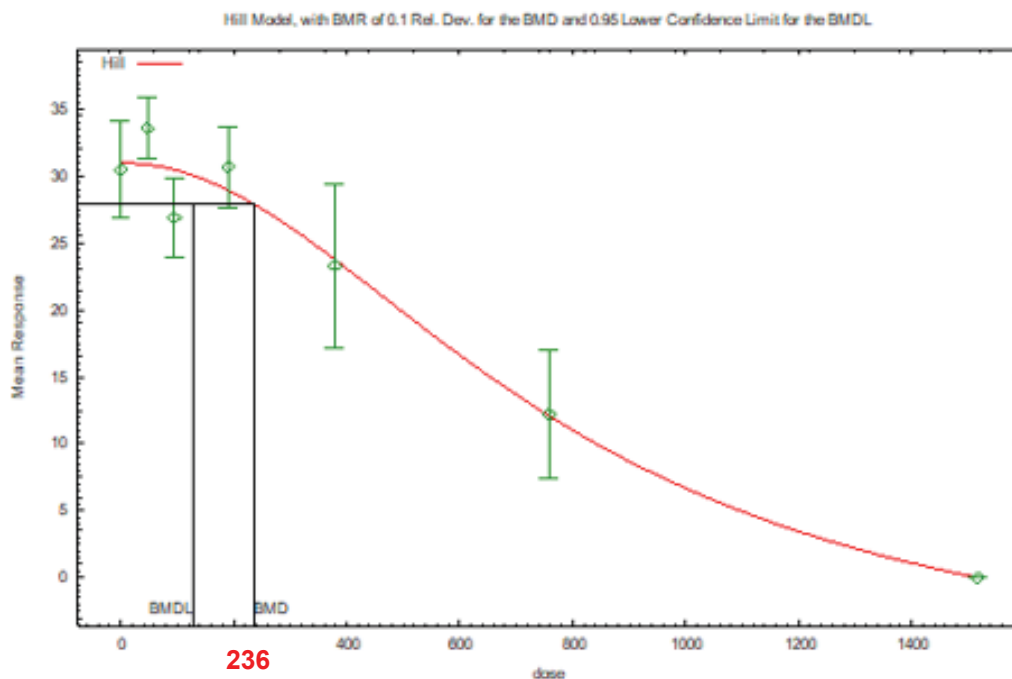
**BMDS Output Plot:  $EC_{10}$  = 80 mg/L**

**Figure B-3.1. *Ceriodaphnia dubia* (WSLH, 2016)  $EC_{10}$  Estimation****b) Soft Water (44 mg  $CaO_3/L$ )****BMDS Input Table: Hill Continuous Model**

| Cl, mg/L | N  | Neonates | St. Dev. |
|----------|----|----------|----------|
| 0        | 10 | 30.5     | 5.10     |
| 47       | 10 | 33.6     | 3.24     |
| 95       | 10 | 26.9     | 4.18     |
| 190      | 10 | 30.7     | 4.27     |
| 379      | 10 | 23.3     | 8.55     |
| 758      | 10 | 12.2     | 6.68     |
| 1517     | 10 | 0        | 0        |

Notes:

Dose was entered as chloride concentration (mg/L); N -replicate number; neonates – number of juveniles in the end of the test; st.dev. – standard deviation

**BMDS Output Plot:  $EC_{10}$  = 236 mg/L**

**c) Moderately Hard Water (89 mg CaO<sub>3</sub>/L)**

| Cl, mg/L | N  | Neonates | St. Dev. |
|----------|----|----------|----------|
| 0        | 10 | 26.1     | 5.78     |
| 47       | 10 | 29.2     | 3.43     |
| 95       | 10 | 29.2     | 1.99     |
| 190      | 10 | 24.9     | 5.36     |
| 379      | 10 | 23       | 7.67     |
| 758      | 10 | 10.4     | 5.91     |
| 1517     | 10 | 0        | 0        |

Dose was entered as chloride concentration (mg/L); N -replicate number; neonates – number of juveniles in the end of the test; st.dev. – standard deviation

Hill Model, with BMR of 0.1 Rel. Dev. for the BMD and 0.95 Lower Confidence Limit for the BMDL

Mean Response

279

200 300

BMDL BMD

0 200 400 600 800 1000 1200 1400

dose

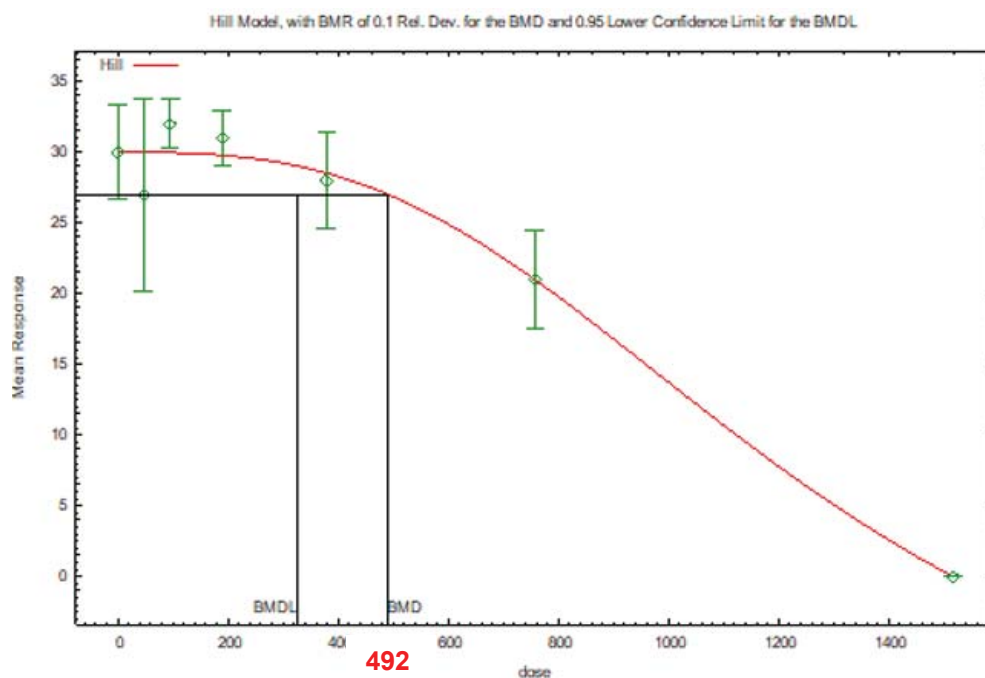


**Figure B-3.1. *Ceriodaphnia dubia* (WSLH, 2016)  $EC_{10}$  Estimation****d) Hard Water (173 mg  $CaO_3/L$ )****BMDS Input Table: Hill Continuous Model**

| Cl, mg/L | N  | Neonates | St. Dev. |
|----------|----|----------|----------|
| 0        | 10 | 30       | 4.7      |
| 47       | 10 | 27       | 9.5      |
| 95       | 10 | 32       | 2.4      |
| 190      | 10 | 31       | 2.8      |
| 379      | 10 | 28       | 4.7      |
| 758      | 10 | 21       | 4.9      |
| 1517     | 10 | 0        | 0        |

**Notes:**

Dose was entered as chloride concentration (mg/L); N -replicate number; neonates – number of juveniles in the end of the test; st.dev. – standard deviation

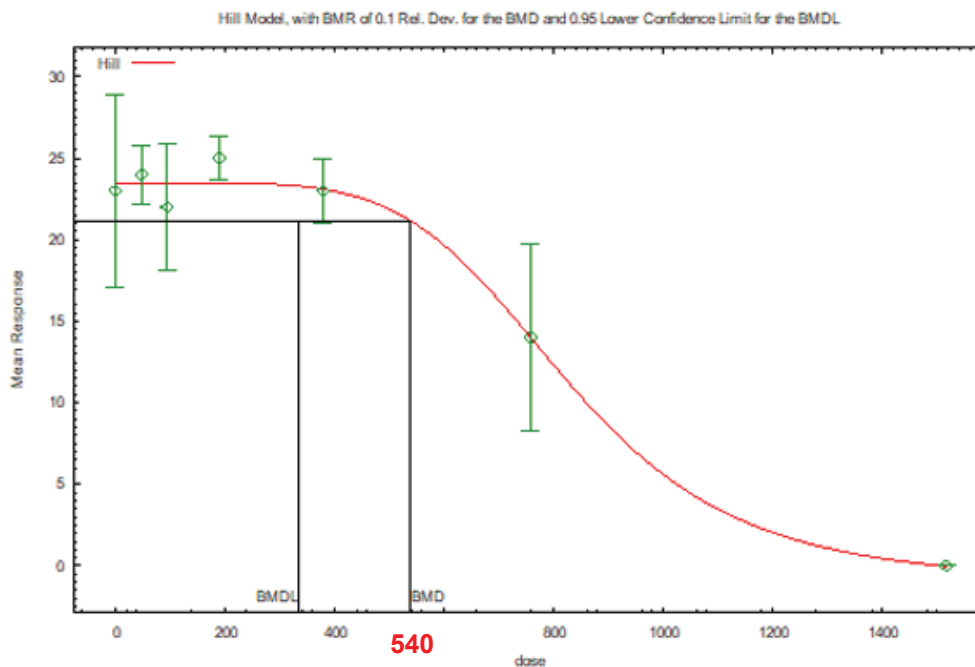
**BMDS Output Plot:  $EC_{10} = 492$  mg/L**

**Figure B-3.1. *Ceriodaphnia dubia* (WSLH, 2016)  $EC_{10}$  Estimation****e) Very Hard Water (350 mg  $CaO_3/L$ )****BMDS Input Table: Hill Continuous Model**

| Cl, mg/L | N  | Neonates | St. Dev. |
|----------|----|----------|----------|
| 0        | 10 | 23       | 8.2      |
| 47       | 10 | 24       | 2.5      |
| 95       | 10 | 22       | 5.5      |
| 190      | 10 | 25       | 1.8      |
| 379      | 10 | 23       | 2.8      |
| 758      | 10 | 14       | 8.0      |
| 1517     | 10 | 0        | 0.0      |

**Notes:**

Dose was entered as chloride concentration (mg/L); N -replicate number; neonates – number of juveniles in the end of the test; st.dev. – standard deviation

**BMDS Output Plot:  $EC_{10}$  = 540 mg/L**

**Figure B-3.2. *Raphidocelis subcapitata* (WSLH, 2016)  $EC_{10}$  Estimation**

**a) Very Soft Water (11 mg  $CaO_3/L$ )**

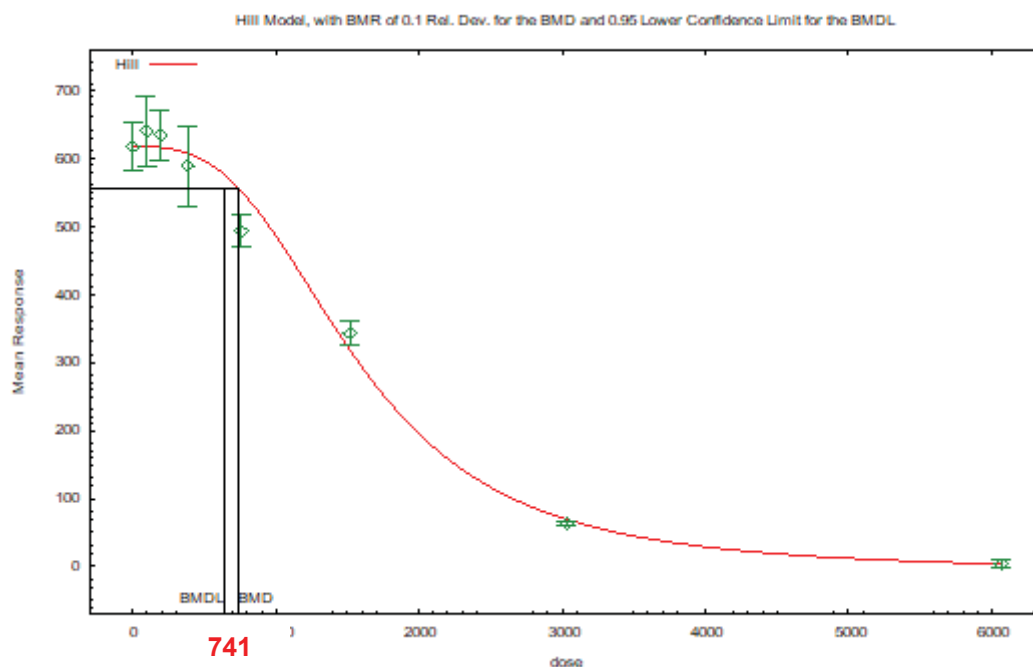
**BMDS Input Table: Hill Continuous Model**

| Cl, mg/L | N | Growth | St. Dev. |
|----------|---|--------|----------|
| 0        | 4 | 617    | 23       |
| 97       | 4 | 640    | 32       |
| 194      | 4 | 634    | 23       |
| 382      | 4 | 589    | 37       |
| 758      | 4 | 493    | 15       |
| 1517     | 4 | 343    | 11       |
| 3033     | 4 | 63     | 2        |
| 6066     | 4 | 4      | 3        |

Notes:

Dose was entered as chloride concentration (mg/L); N -replicate number; growth – measured as fluorescence in the end of the test; st.dev. – standard deviation

**BMDS Output Plot:  $EC_{10}$  = 741 mg/L**

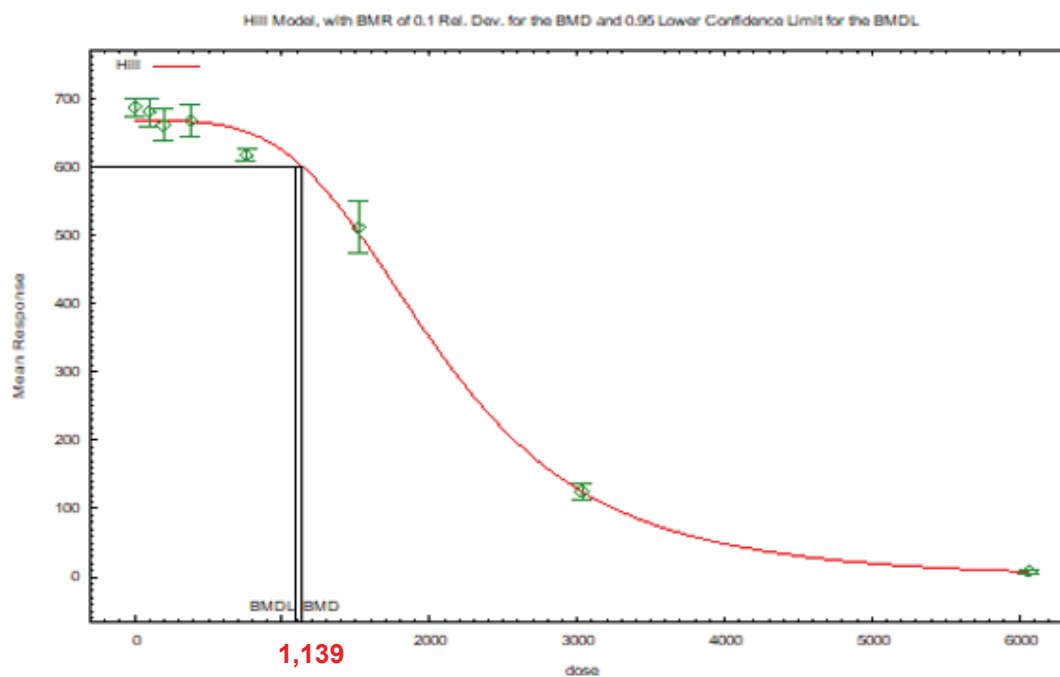


**Figure B-3.2. *Raphidocelis subcapitata* (WSLH, 2016)  $EC_{10}$  Estimation****b) Soft Water (44 mg  $CaO_3/L$ )****BMDS Input Table: Hill Continuous Model**

| Cl, mg/L | N | Growth | St. Dev. |
|----------|---|--------|----------|
| 0        | 4 | 687    | 8        |
| 97       | 4 | 680    | 13       |
| 194      | 4 | 661    | 15       |
| 382      | 4 | 667    | 15       |
| 758      | 4 | 617    | 5        |
| 1517     | 4 | 511    | 24       |
| 3033     | 4 | 125    | 8        |
| 6066     | 4 | 8      | 2        |

**Notes:**

Dose was entered as chloride concentration (mg/L); N -replicate number; growth – measured as fluorescence in the end of the test; st.dev. – standard deviation

**BMDS Output Plot:  $EC_{10} = 1,139$  mg/L**

**Figure B-3.2. *Raphidocelis subcapitata* (WSLH, 2016)  $EC_{10}$  Estimation**

**c) Moderately Hard Water (89 mg  $CaO_3/L$ )**

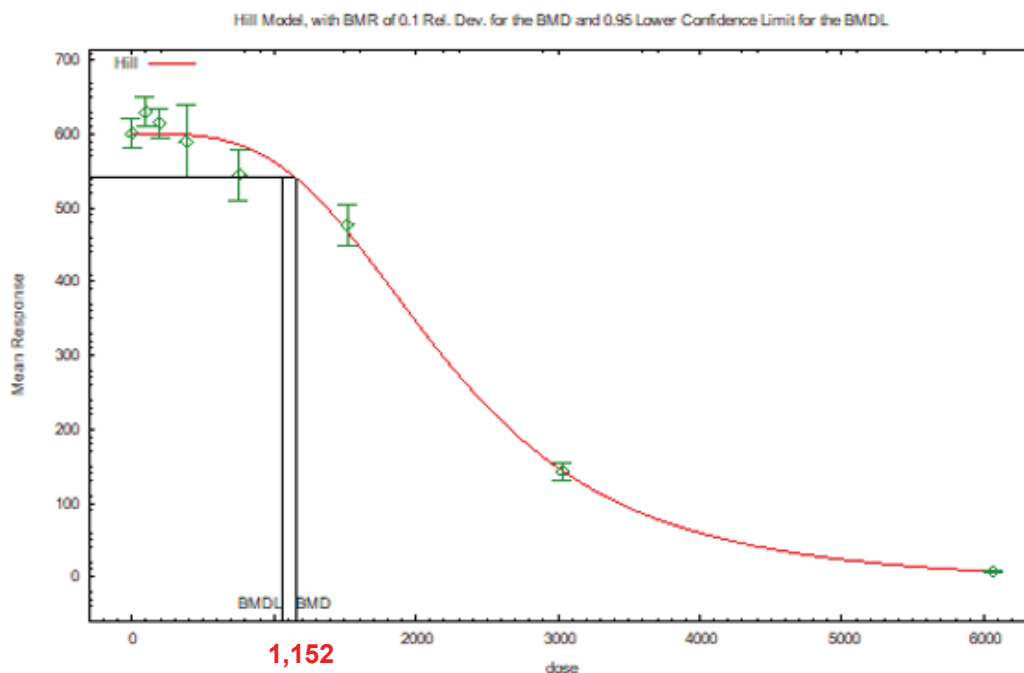
**BMDS Input Table: Hill Continuous Model**

| Cl, mg/L | N | Growth | St. Dev. |
|----------|---|--------|----------|
| 0        | 4 | 601    | 13       |
| 97       | 4 | 630    | 13       |
| 194      | 4 | 615    | 12       |
| 382      | 4 | 590    | 31       |
| 758      | 4 | 545    | 22       |
| 1517     | 4 | 477    | 17       |
| 3033     | 4 | 143    | 7        |
| 6066     | 4 | 7      | 1        |

Notes:

Dose was entered as chloride concentration (mg/L); N -replicate number; growth – measured as fluorescence in the end of the test; st.dev. – standard deviation

**BMDS Output Plot:  $EC_{10} = 1,152$  mg/L**



**Figure B-3.2. *Raphidocelis subcapitata* (WSLH, 2016)  $EC_{10}$  Estimation**

**d) Hard Water (173 mg  $CaO_3/L$ )**

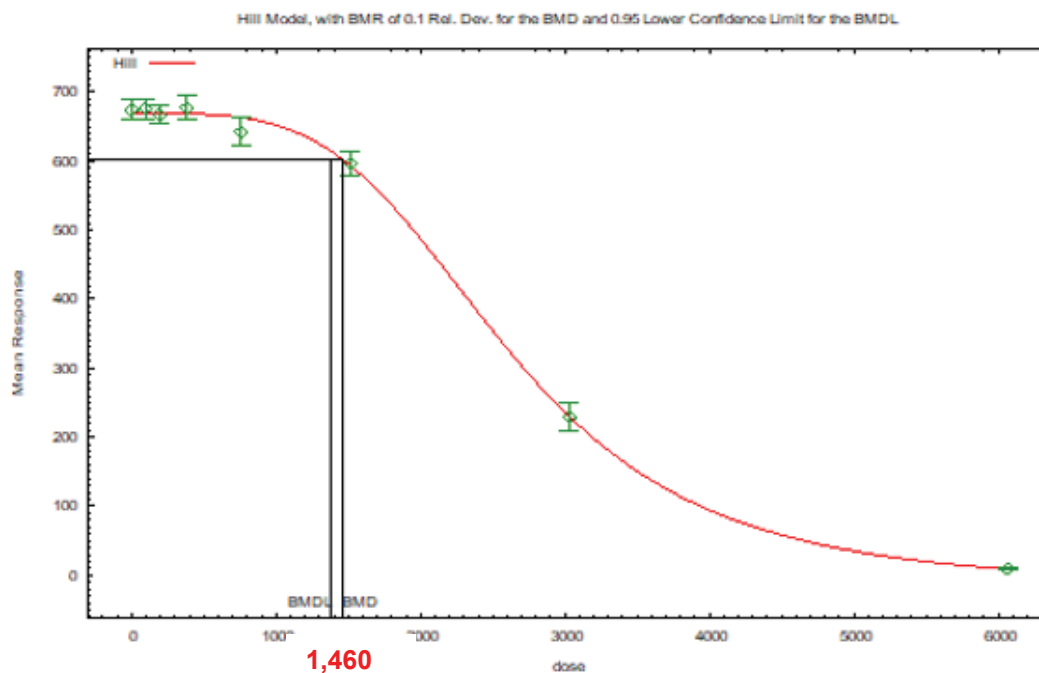
**BMDS Input Table: Hill Continuous Model**

| Cl, mg/L | N | Growth | St. Dev. |
|----------|---|--------|----------|
| 0        | 4 | 674    | 9        |
| 97       | 4 | 676    | 9        |
| 194      | 4 | 667    | 8        |
| 382      | 4 | 677    | 11       |
| 758      | 4 | 642    | 13       |
| 1,517    | 4 | 596    | 11       |
| 3,033    | 4 | 229    | 13       |
| 6,066    | 4 | 9      | 1        |

**Notes:**

Dose was entered as chloride concentration (mg/L); N -replicate number; growth – measured as fluorescence in the end of the test; st.dev. – standard deviation

**BMDS Output Plot:  $EC_{10} = 1,460$  mg/L**



**Figure B-3.2. *Raphidocelis subcapitata* (WSLH, 2016)  $EC_{10}$  Estimation**

**e) Very Hard Water (350 mg  $CaO_3/L$ )**

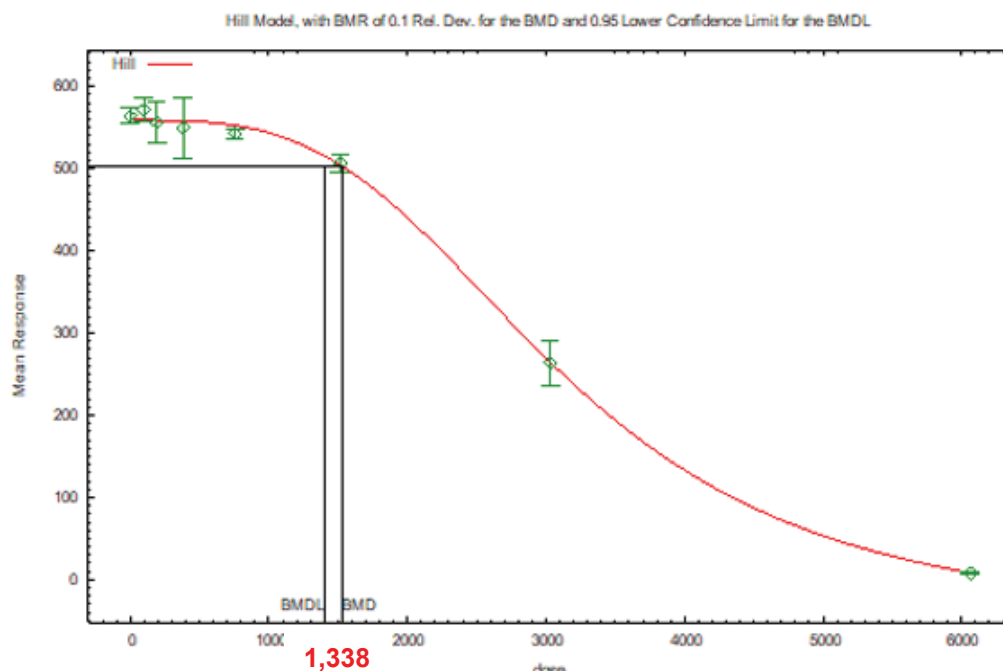
**BMD5 Input Table: Hill Continuous Model**

| Cl, mg/L | N | Growth | St. Dev. |
|----------|---|--------|----------|
| 0        | 4 | 600    | 6        |
| 97       | 4 | 605    | 5        |
| 194      | 4 | 599    | 9        |
| 382      | 4 | 591    | 9        |
| 758      | 4 | 568    | 11       |
| 1,517    | 4 | 521    | 18       |
| 3,033    | 4 | 270    | 27       |
| 6,066    | 4 | 14     | 3        |

Notes:

Dose was entered as chloride concentration (mg/L); N -replicate number; growth – measured as fluorescence in the end of the test; st.dev. – standard deviation

**BMD5 Output Plot:  $EC_{10} = 1,338$  mg/L**

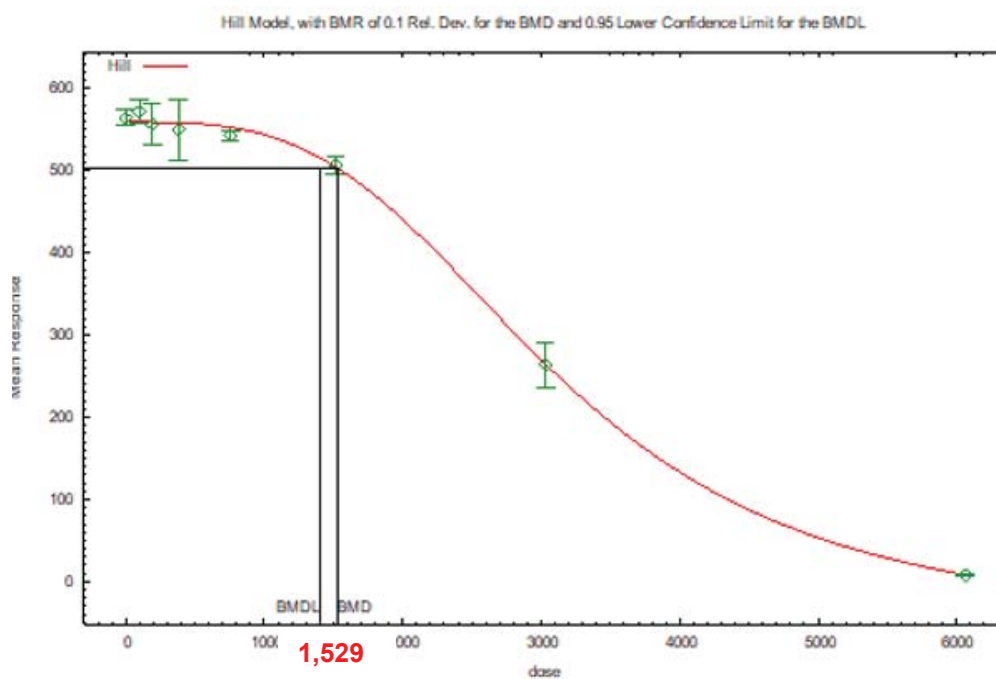


**Figure B-3.2. *Raphidocelis subcapitata* (WSLH, 2016)  $EC_{10}$  Estimation****f) Extremely Hard Water (576 mg  $CaO_3/L$ )****BMDS Input Table: Hill Continuous Model**

| Cl, mg/L | N | Growth | St. Dev. |
|----------|---|--------|----------|
| 0        | 4 | 564    | 6        |
| 97       | 4 | 572    | 9        |
| 194      | 4 | 556    | 16       |
| 382      | 4 | 550    | 23       |
| 758      | 4 | 543    | 4        |
| 1,517    | 4 | 507    | 7        |
| 3,033    | 4 | 264    | 17       |
| 6,066    | 4 | 8      | 1        |

Notes:

Dose was entered as chloride concentration (mg/L); N -replicate number; growth – measured as fluorescence in the end of the test; st.dev. – standard deviation

**BMDS Output Plot:  $EC_{10} = 1,529$  mg/L**



#### B-4. Wisconsin State Laboratory of Hygiene (WSLH) 2017: *Pseudokirchneriella subcapitata* Multi-Salt Toxicity Testing

In 2017, WSLH completed the multi-salt test to compare the Cl toxicity from NaCl, Na<sub>2</sub>SO<sub>4</sub>, NaHCO<sub>3</sub>, MgCl<sub>2</sub>, MgSO<sub>4</sub>, CaCl<sub>2</sub>, CaSO<sub>4</sub>, and KCl in the moderately hard reconstituted water (MHRW). First, algae were tested in a medium with a standard nutrient volume (all 0.1 mL/100mL), and next, the 10X phosphorus (P) and 10X selenium/molybdenum (Se/Mo) were added.

The derived IC<sub>50</sub>, IC<sub>20</sub>, and IC<sub>10</sub> are summarized in Table B-4.1. Figure B-4.1 to B-4.7 show the derived dose-response curves.

| Salt Solution                              | IC <sub>50</sub> | IC <sub>20</sub> | IC <sub>10</sub> | Variance Model |
|--------------------------------------------|------------------|------------------|------------------|----------------|
| <b>2015 Hardness Testing</b>               |                  |                  |                  |                |
| NaCl - Very Soft Water                     | 2465             | 1536             | 1210             | LTS            |
| NaCl - Soft Water                          | 2967             | 1753             | 1345             | LTS            |
| NaCl – Mod Hard                            | 3762             | 2770             | 2316             | LLG            |
| NaCl – Hard                                | 4259             | 3220             | 2735             | LLG            |
| NaCl – Very Hard                           | 4589             | 2811             | 2388             | LL             |
| NaCl – Extremely Hard                      | 4719             | 2968             | 2542             | LL             |
| <b>2016-2017 Multi Salt</b>                |                  |                  |                  |                |
| Na <sub>2</sub> SO <sub>4</sub>            | 5179             | 3923             | 3335             | LLG            |
| KCl                                        | 3801             | 2559             | 2096             | LTS            |
| NaCl                                       | 3857             | 2562             | 2085             | LTS            |
| MgCl <sub>2</sub>                          | 2130             | 1112             | 801              | LTS            |
| CaSO <sub>4</sub>                          | 1728             | 313              | 133              | LLG            |
| NaHCO <sub>3</sub>                         | 2593             | 2142             | 1916             | LLG            |
| MgSO <sub>4</sub>                          | 4536             | 3095             | 2552             | LTS            |
| CaCl <sub>2</sub>                          | 3189             | 2259             | 1847             | LLG            |
| <b>2016-2017 Multi Salt – Nutrient Sup</b> |                  |                  |                  |                |
| MgCl <sub>2</sub>                          | 2552             | 1932             | 1641             | LLG            |
| CaSO <sub>4</sub>                          | >Sat             | >Sat             | 537              | BMDS - Hill    |
| MgSO <sub>4</sub>                          | 5231             | 3884             | 3263             | LLG            |
| CaCl <sub>2</sub>                          | 3177             | 2430             | 2123             | LTS            |
| <b>2016-2017 Multi Salt – 10x Nutrient</b> |                  |                  |                  |                |
| CaCl <sub>2</sub>                          | 502              | 300              | 222              | LLG            |
| KCl                                        | 3447             | 2541             | 2126             | LLG            |
| Na <sub>2</sub> SO <sub>4</sub>            | 6056             | 4336             | 3879             | LLG            |
| MgCl <sub>2</sub>                          | 2799             | 2160             | 1856             | LLG            |
| CaSO <sub>4</sub>                          | 596              | 276              | 176              | LLG            |
| NaCl                                       | 4229             | 2872             | 2363             | LTS            |
| MgSO <sub>4</sub>                          | 3464             | 1705             | 1346             | LL             |
| NaHCO <sub>3</sub>                         | 3158             | 2297             | 1907             | LLG            |

LL = log linear variance model; LLG = log logistic variance model, LTS = log threshold sigma variance model, BMDS-Hill = USEPA Benchmark Dose Software – Hill model – unless indicated USEPA TRAP software used.

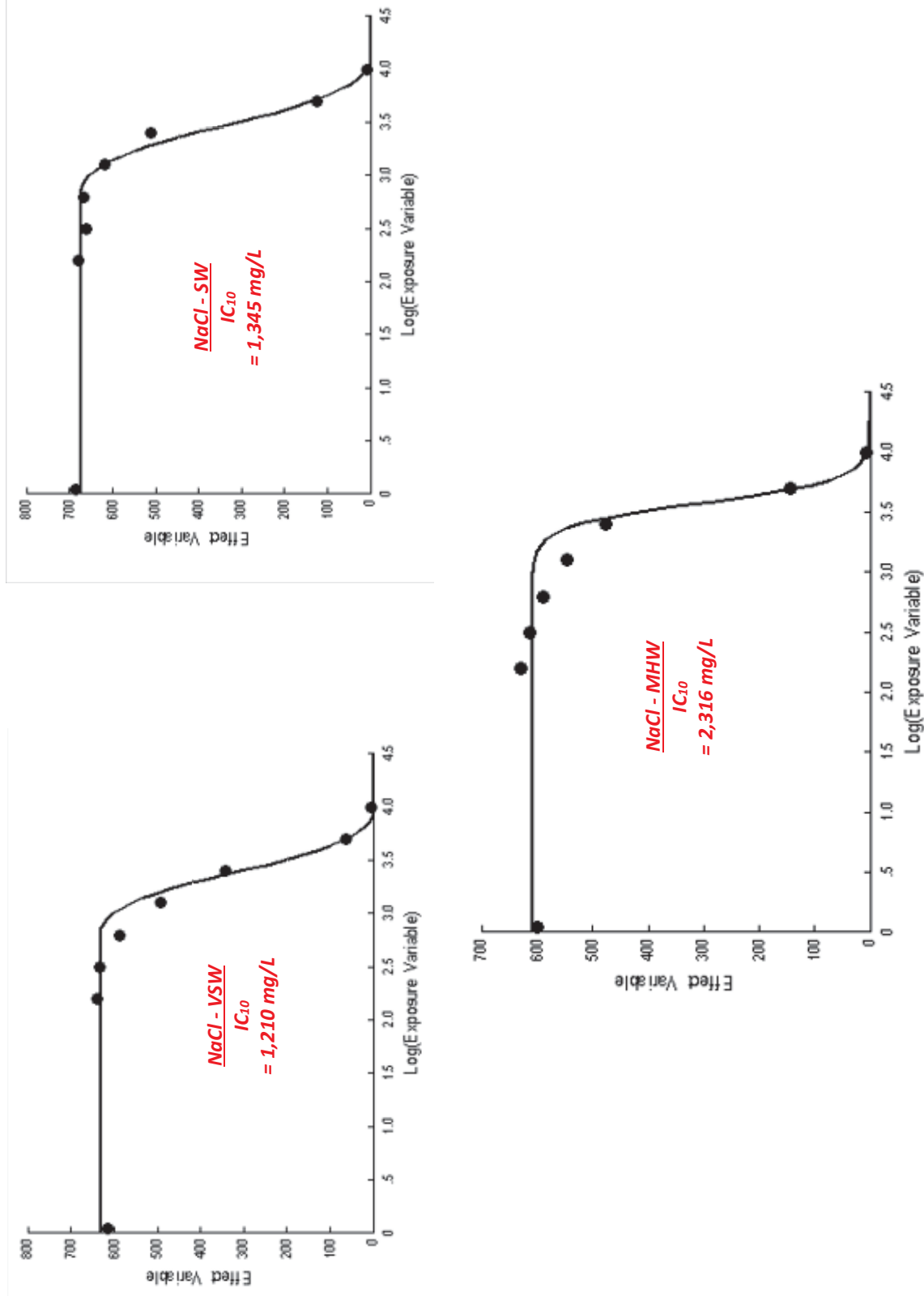
Figure B-4.1. *P. subcapitata*: NaCl Dose-Response in VSW, SW, & MHW

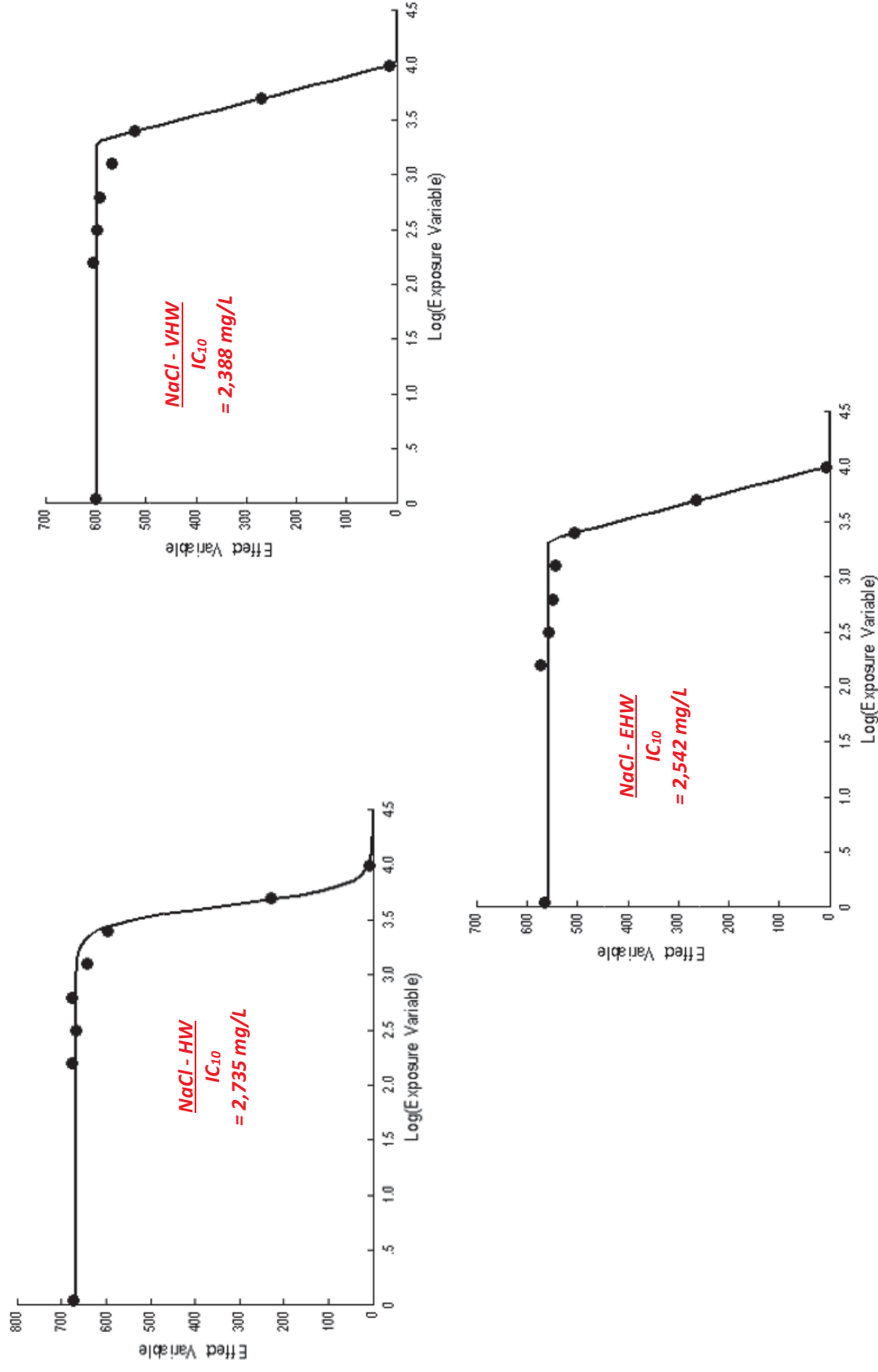
Figure B-4.2. *P. subcapitata*: NaCl Dose-Response in HW, VHW, & EHW

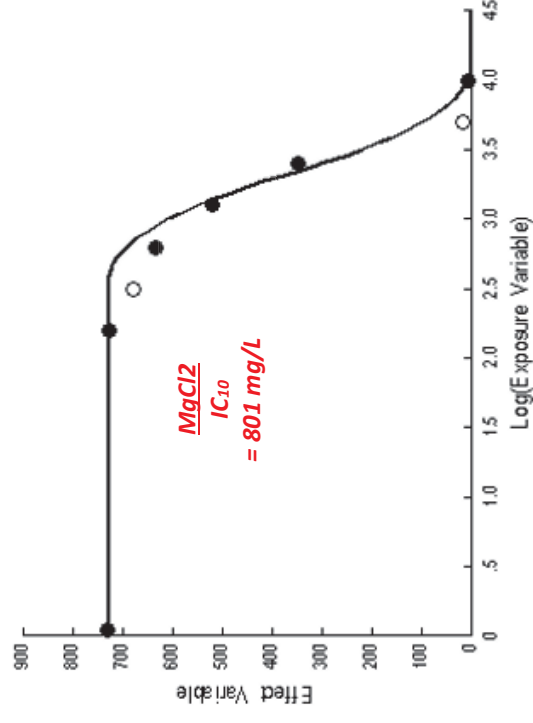
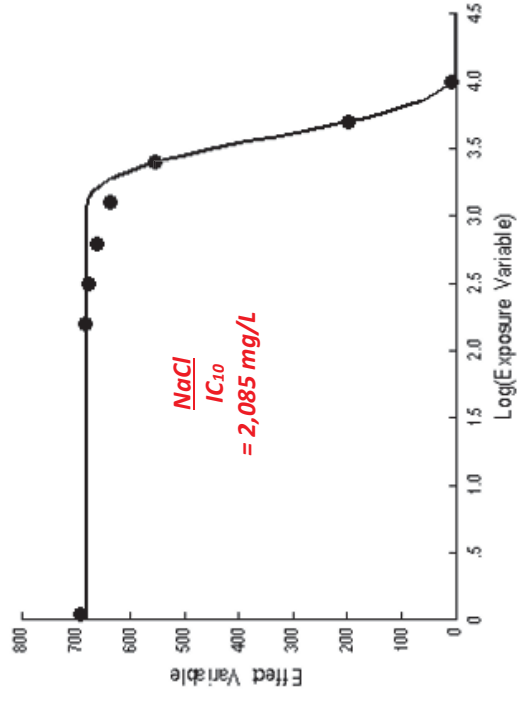
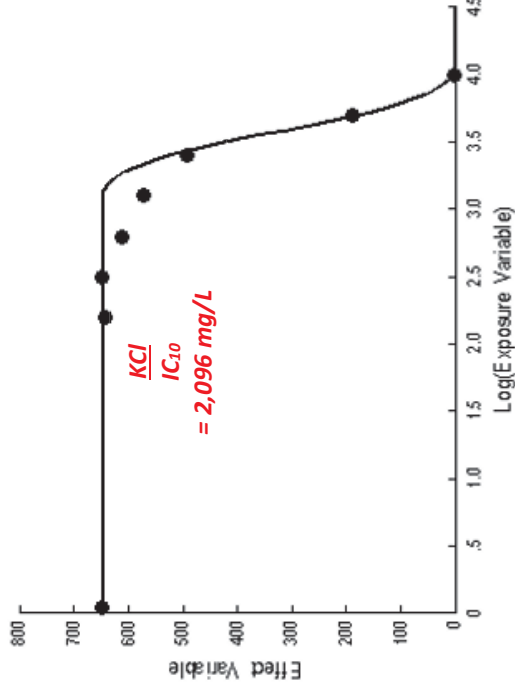
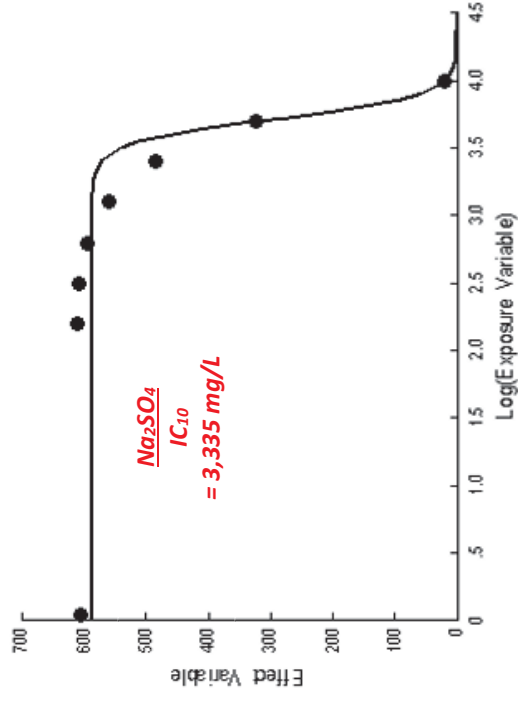
Figure B-4.3. *P. subcapitata*: Multi Salt – Na<sub>2</sub>SO<sub>4</sub>, KCl, NaCl, & MgCl<sub>2</sub>

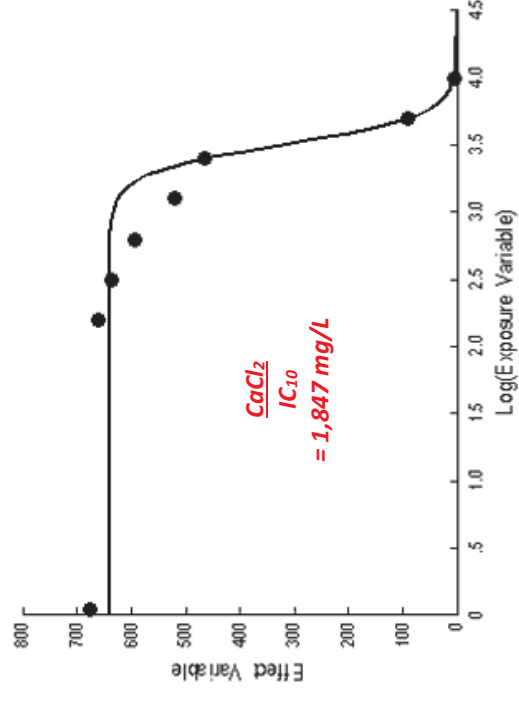
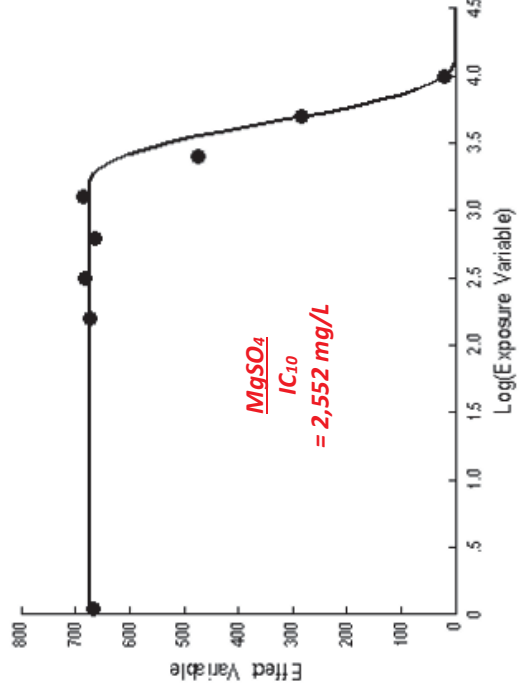
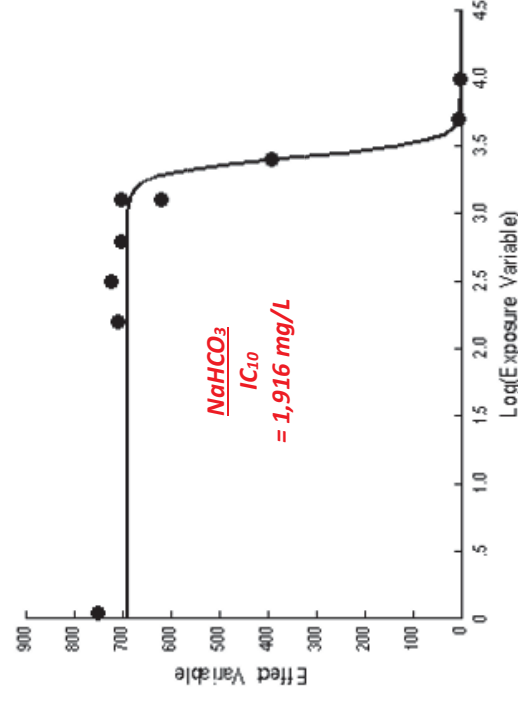
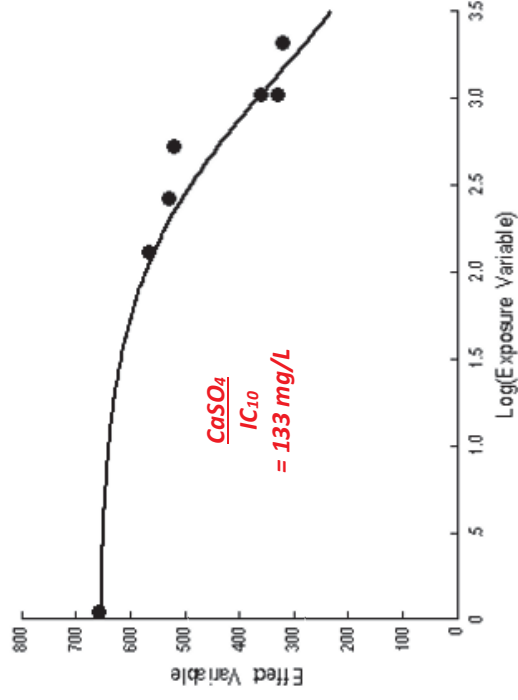
Figure B-4. *P. subcapitata*: Multi Salt –  $\text{CaSO}_4$ ,  $\text{NaHCO}_3$ ,  $\text{MgSO}_4$ , &  $\text{CaCl}_2$ 

Figure B-4.5. *P. subcapitata*: Multi Salt – Nutrient Supplement –  $\text{MgCl}_2$ ,  $\text{CaSO}_4$ ,  $\text{MgSO}_4$ , &  $\text{CaCl}_2$

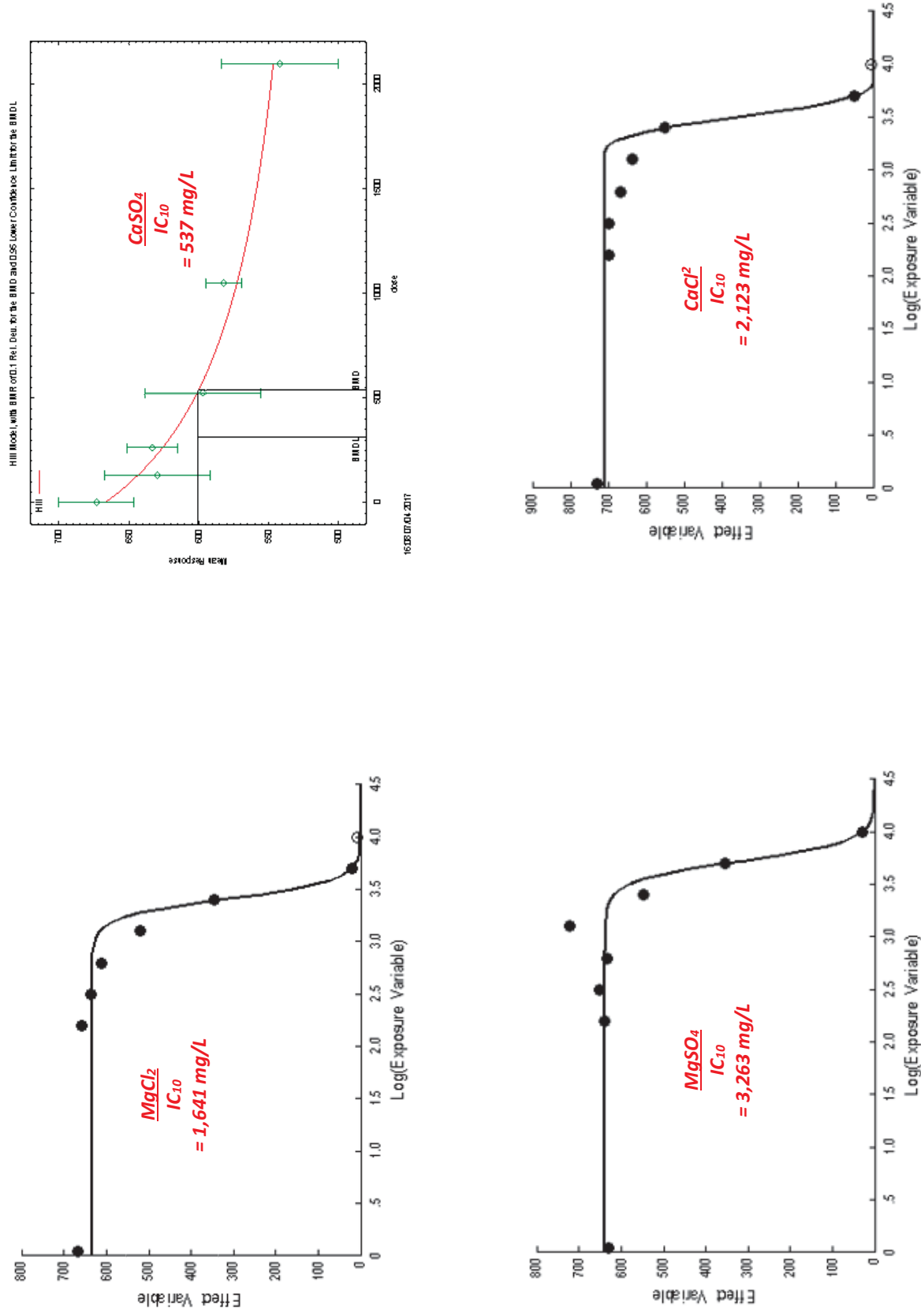


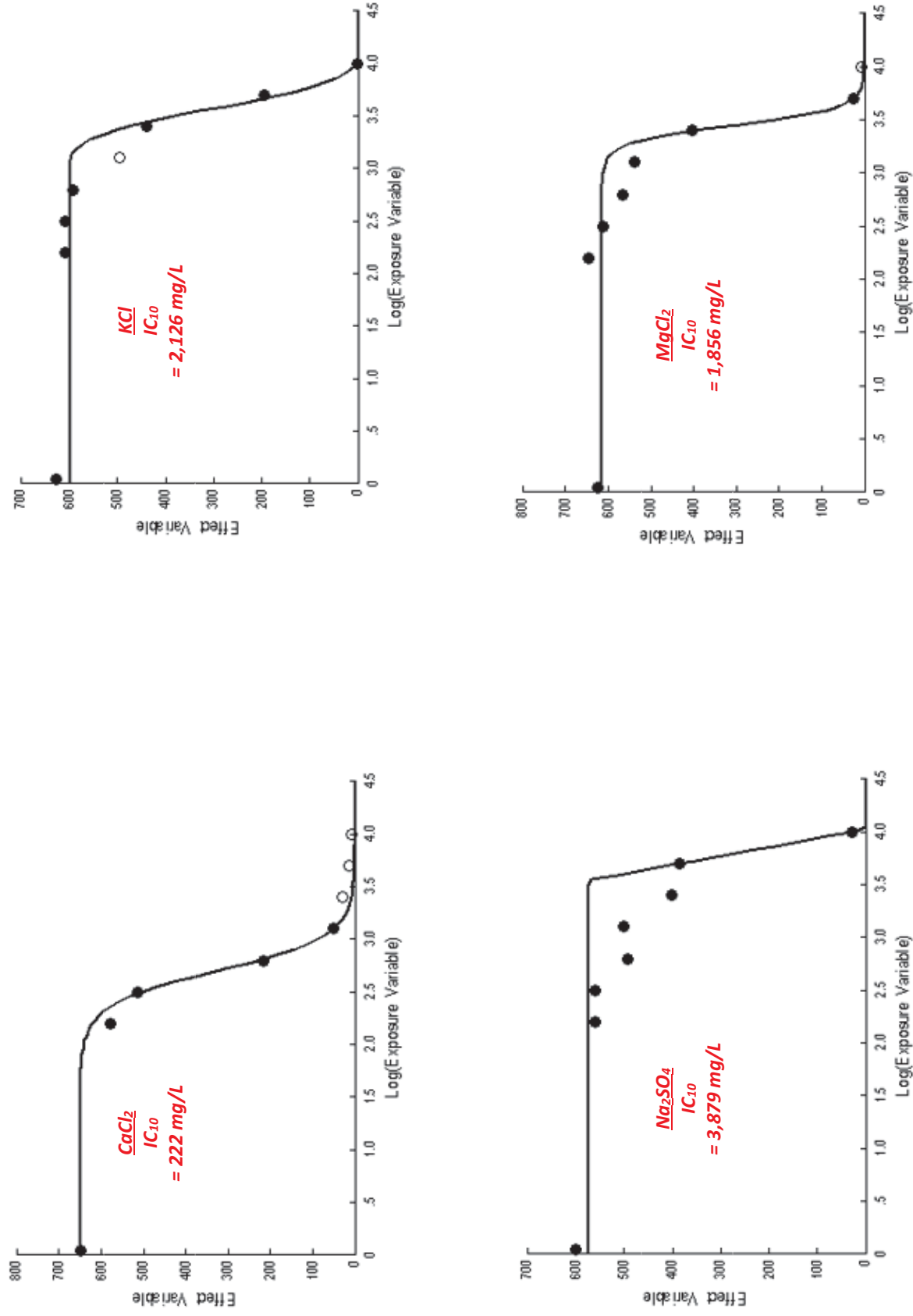
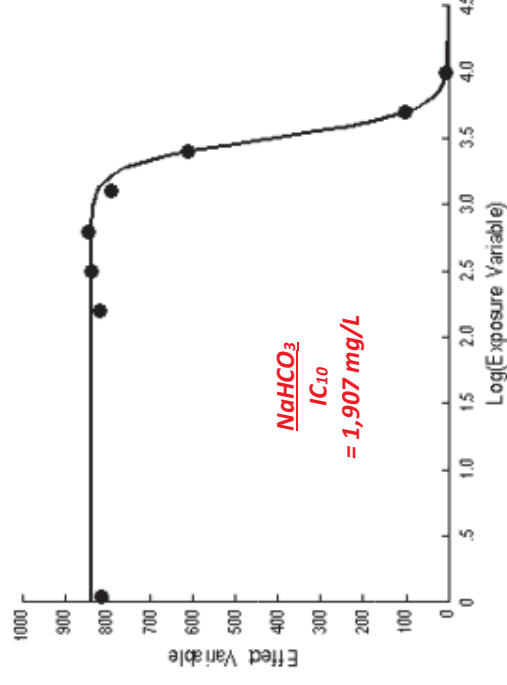
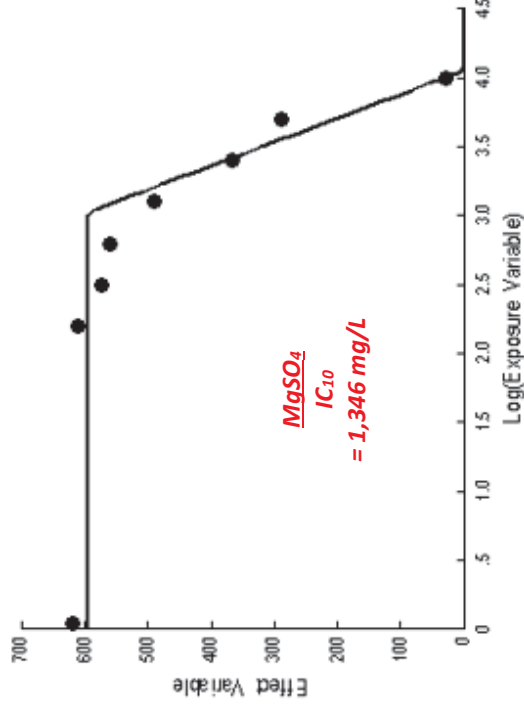
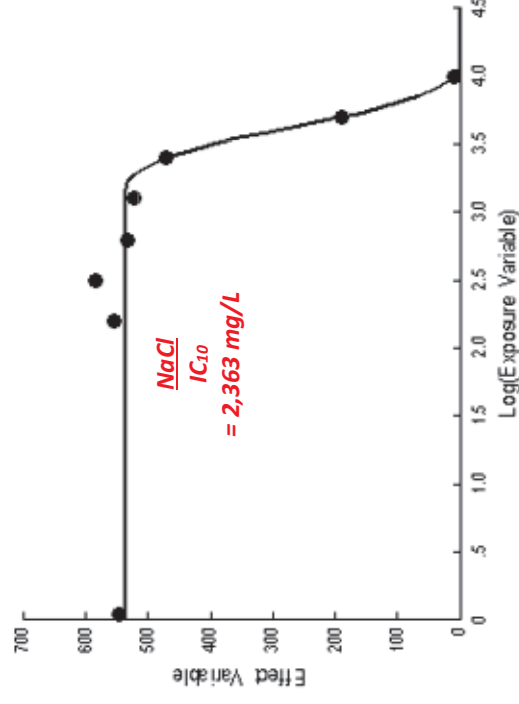
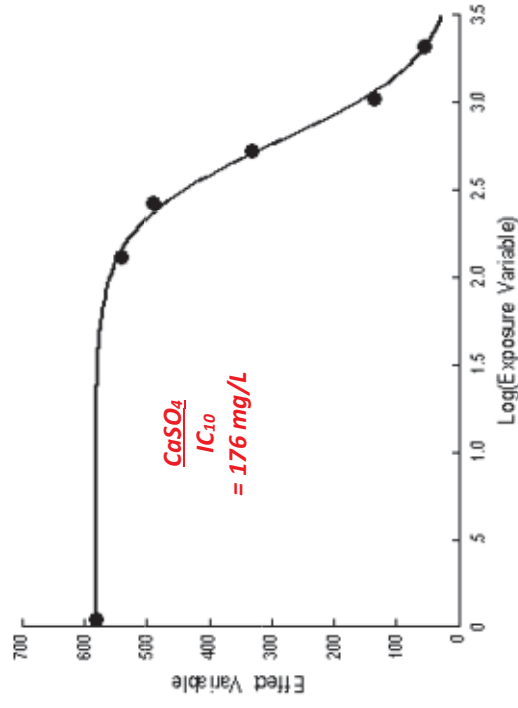
Figure B-4.6. *P. subcapitata*: Multi Salt – 10 x Nutrient Supplement – CaCl<sub>2</sub>, KCl, Na<sub>2</sub>SO<sub>4</sub>, & MgCl<sub>2</sub>

Figure B-4.7. *P. subcapitata*: Multi Salt – 10 x Nutrient Supplement – CaSO<sub>4</sub>, NaCl, MgSO<sub>4</sub>, & NaHCO<sub>3</sub>



**B-5. Nautilus Environmental 2016 and 2019:  
*Lithobates pipiens* and *Centroptilum (Neocloeon) triangulifer*  
Chloride Toxicity Testing**

In 2016 and 2019 Nautilus Environmental (Nautilus) examined the ameliorating effects of hardness on sodium chloride toxicity for the following species:

*L. pipiens* (northern leopard frog);  
*C. (Neocloeon) triangulifer* (mayfly).

The long-term static-renewal test for *L. pipiens* (tadpole stage) lasted for 2,040-2,136 hours, and included three water hardness levels, such as very soft, moderately hard, and very hard water (8, 90, and 300 mg/L, respectively). Mortality, biomass, and length biological endpoints were measured. By the end of the work, Nautilus (2016) provided a draft report with detail methodology and laboratory records, attached in the end of Appendix B. The EC<sub>20</sub> values, based on the biomass toxicological endpoint, of 801 mg/kg, 2,723 mg/kg, and 2,800 mg/kg were calculated by EEI for the very soft, moderately hard, and very hard water, respectively. The EC<sub>20</sub> values were calculated using BMDS 3.2 software, with continuous model. Corresponding toxicological endpoints, calculated with BMDS 3.2 software, and used for the guideline derivation, are present in Figure B-5.1.

The long-term static-renewal test for *C. triangulifer* was conducted on the organisms <48 hr old, and lasted for 28 days, comparing the soft (42 mg/L), moderately hard (84 mg/L), hard (85 mg/L) and very hard (300 mg/L) water levels. Biological endpoints, such as mortality, emergence, and biomass, were measured. By the end of the work, Nautilus (2019) provided a final report with detail methodology and laboratory records, attached in the end of Appendix B. The LC<sub>20</sub> values, based on the survival toxicological endpoint, of 361 mg/kg, 243 mg/kg, 373, and 502 mg/kg were calculated by EEI, for the soft, moderately hard, hard, and very hard water, respectively. The LC<sub>20</sub> values were calculated using BMDS 2.7.04 software, with dichotomous or continuous model. Corresponding toxicological endpoints, calculated with BMDS 2.7.0.4. software, and used for the guideline derivation, are present in Figure B-5.2.

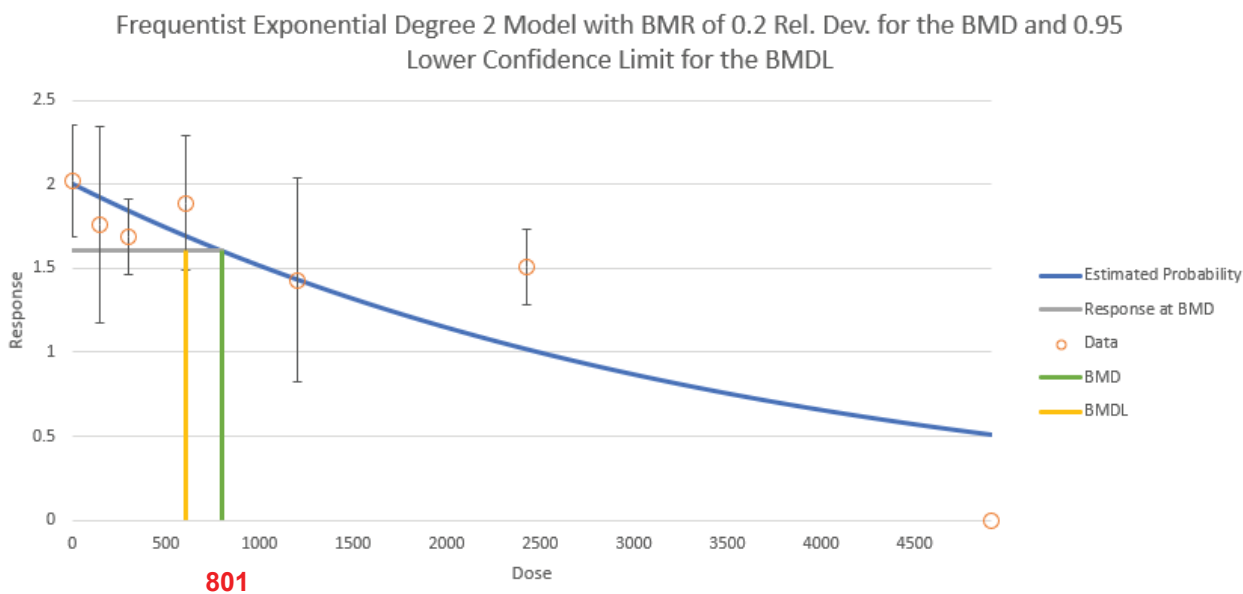
**Figure B-5.1. *Lithobates pipiens* EC<sub>20</sub> Estimation****a) Very Soft Water (8 mg CaO<sub>3</sub>/L)****BMDS Input Table: Exponential Degree 2 Model**

| Dose  | N | Mean Response | St. Dev. |
|-------|---|---------------|----------|
| 2.7   | 4 | 2.02          | 0.21     |
| 143   | 4 | 1.76          | 0.37     |
| 297   | 4 | 1.69          | 0.14     |
| 605   | 4 | 1.89          | 0.25     |
| 1,204 | 4 | 1.43          | 0.38     |
| 2,426 | 4 | 1.51          | 0.14     |
| 4,910 | 4 | 0.00          | 0.00     |

Notes:

Dose- Chloride, mg/L; N -replicate number; mean response – biomass in grams in the end of the test; st.dev. – standard deviation

Original data report prepared by Nautilus (2016) is provided in the end of Appendix B.

**BMDS Output Plot: LC<sub>20</sub> = 801 mg/L**

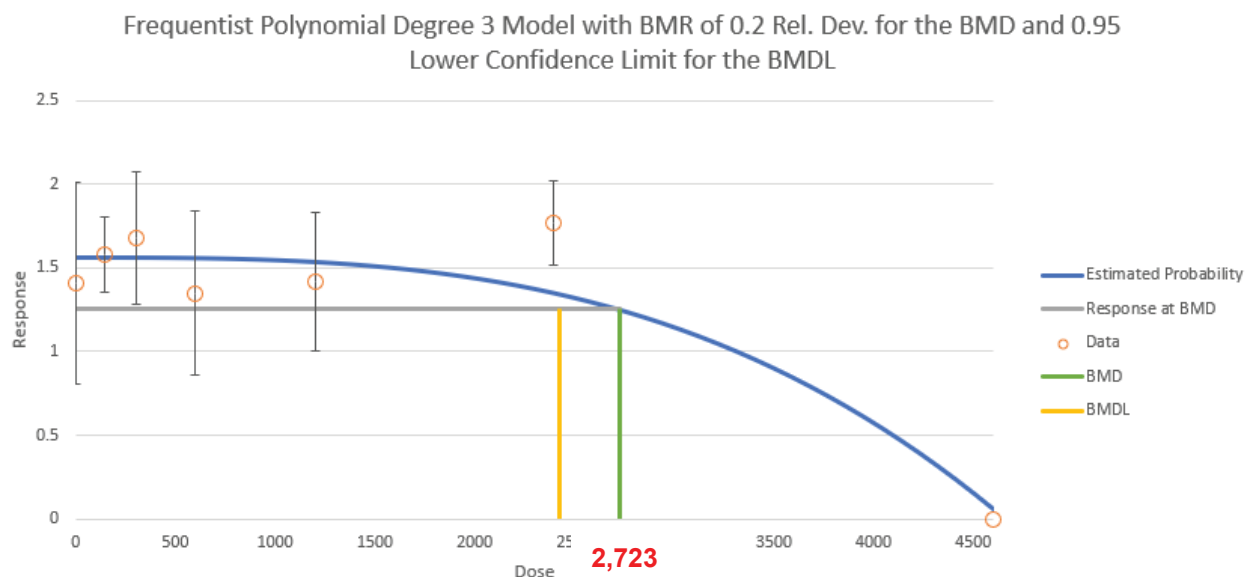
**Figure B-5.1. *Lithobates pipiens* EC<sub>20</sub> Estimation****b) Moderately Hard Water (90 mg CaO<sub>3</sub>/L)****BMDS Input Table: Polynomial Degree 3 Model**

| Dose  | N | Mean Response | St. Dev. |
|-------|---|---------------|----------|
| 4.9   | 4 | 1.41          | 0.38     |
| 148   | 4 | 1.58          | 0.14     |
| 306   | 4 | 1.68          | 0.25     |
| 601   | 4 | 1.35          | 0.31     |
| 1,200 | 4 | 1.42          | 0.26     |
| 2,396 | 4 | 1.77          | 0.16     |
| 4,600 | 4 | 0.00          | 0.00     |

Notes:

Dose- Chloride, mg/L; N -replicate number; mean response – biomass in grams in the end of the test; st.dev. – standard deviation

Original data report prepared by Nautilus (2016) is provided in the end of Appendix B.

**BMDS Output Plot: LC<sub>20</sub> = 2,723 mg/L**

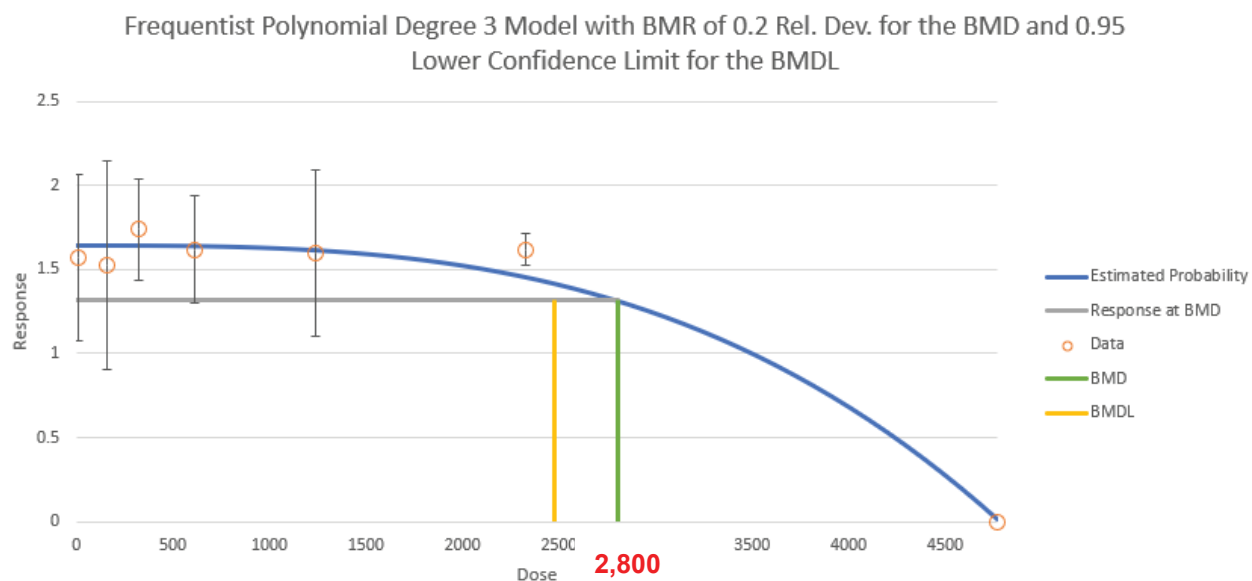
**Figure B-5.1. *Lithobates pipiens* EC<sub>20</sub> Estimation****c) Very Hard Water (300 mg CaO<sub>3</sub>/L)****BMDS Input Table: Polynomial Degree 3 Model**

| Dose  | N | Mean Response | St. Dev. |
|-------|---|---------------|----------|
| 10.5  | 4 | 1.57          | 0.31     |
| 162   | 4 | 1.53          | 0.39     |
| 320   | 4 | 1.74          | 0.19     |
| 614   | 4 | 1.62          | 0.20     |
| 1,242 | 4 | 1.60          | 0.31     |
| 2,330 | 4 | 1.62          | 0.06     |
| 4,770 | 4 | 0.00          | 0.00     |

Notes:

Dose- Chloride, mg/L; N -replicate number; mean response – biomass in grams in the end of the test; st.dev. – standard deviation

Original data report prepared by Nautilus (2016) is provided in the end of Appendix B.

**BMDS Output Plot: LC<sub>20</sub> = 2,800 mg/L**

**Figure B-5.2. *Centropomus (Neocloeon) triangulifer* LC<sub>20</sub> Estimation****a) Soft Water (42 mg CaO<sub>3</sub>/L)****BMDS Input Table: Hill Continuous Model**

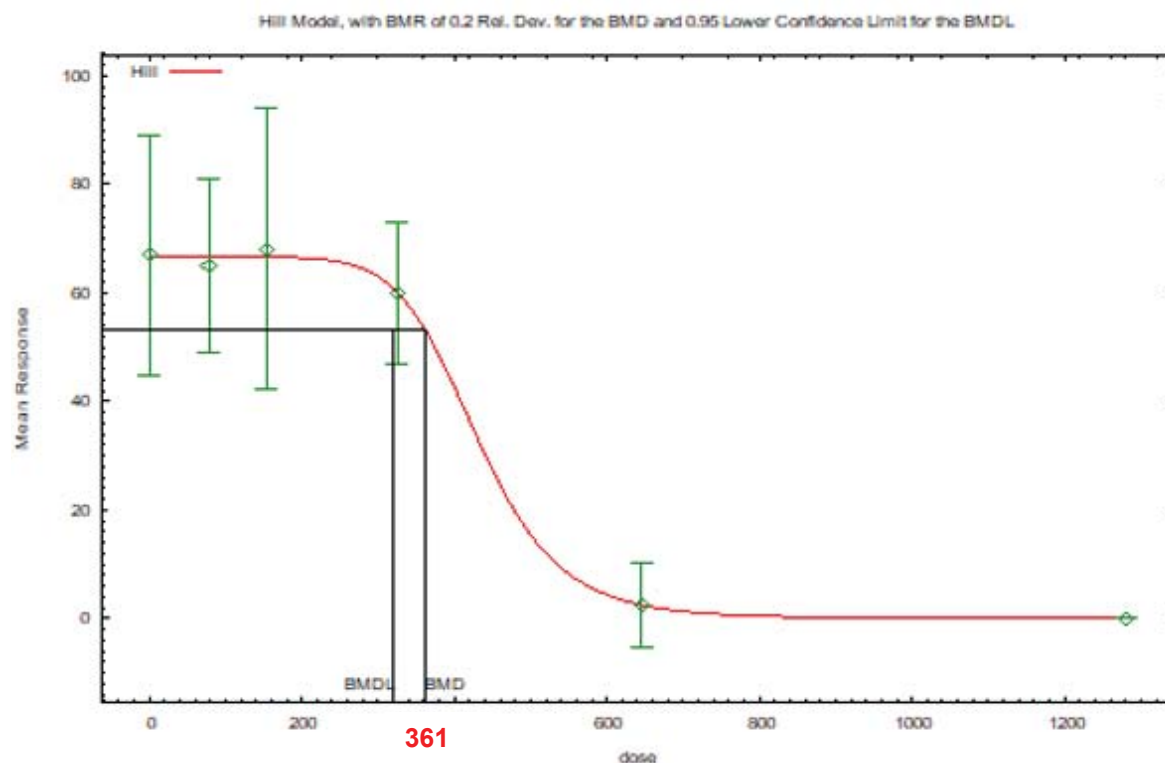
| Dose  | N  | Mean Response | St. Dev. |
|-------|----|---------------|----------|
| 1.21  | 3* | 67            | 8.9      |
| 78    | 4  | 65            | 10       |
| 154   | 4  | 68            | 16.3     |
| 326   | 4  | 60            | 8.2      |
| 646   | 4  | 2.5           | 5        |
| 1,280 | 4  | 0             | 0        |

Notes:

Dose- Chloride, mg/L; N -replicate number; mean response – survival percentage; st.dev. – standard deviation

\*High mortality in one replicate was observed due to dropped DO (Nautilus, 2019); and this replicate was not included in the final statistics;

Original data report prepared by Nautilus (2019) is provided in the end of Appendix B.

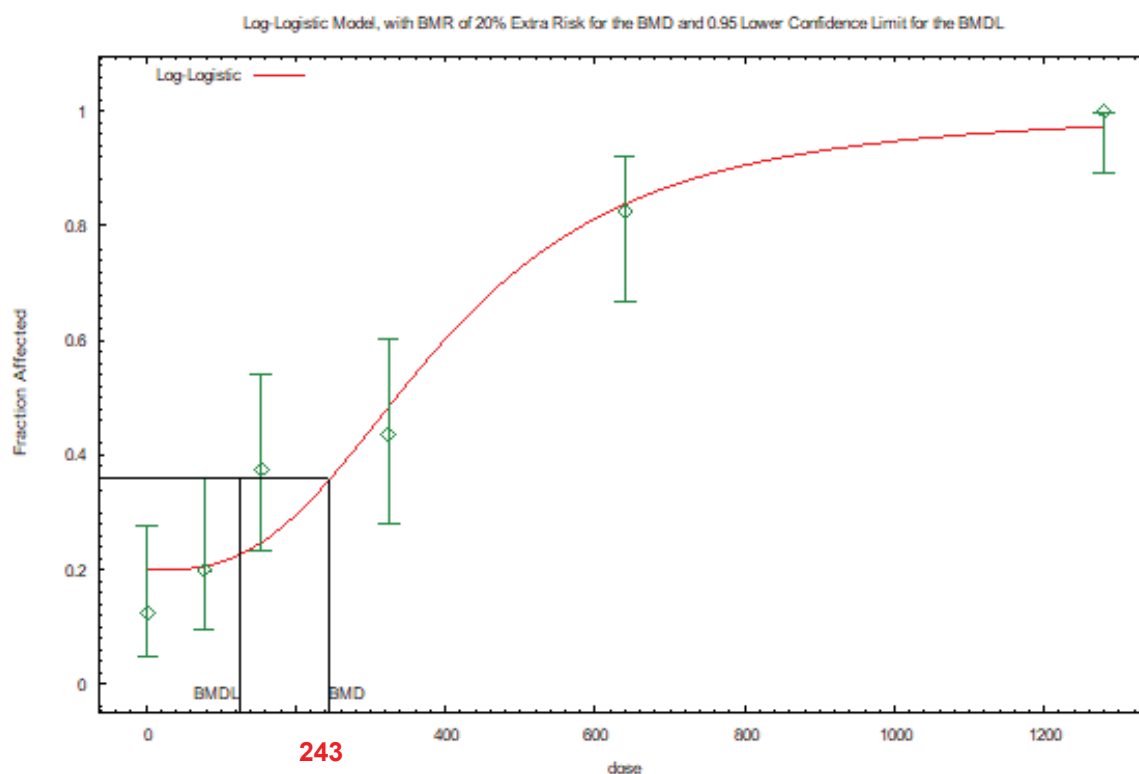
**BMDS Output Plot: LC<sub>20</sub> = 361 mg/L**

**Figure B-5.2. *Centropomus (Neocloeon) triangulifer* LC<sub>20</sub> Estimation****b) Moderately Hard Water****BMDS Input Table: Log-Logistic Dichotomous Model**

| Dose  | N  | Effect |
|-------|----|--------|
| 2.25  | 40 | 5      |
| 78    | 40 | 8      |
| 154   | 40 | 15     |
| 324   | 39 | 17     |
| 640   | 40 | 33     |
| 1,280 | 40 | 40     |

Notes:

Dose- Chloride, mg/L; N – number of organisms per dose, effect – number of organisms affected  
 Original data report prepared by Nautilus (2019) is provided in the end of Appendix B.

**BMDS Output Plot: LC<sub>20</sub> = 243 mg/L**

**Figure B-5.2. *Centropetulum (Neocloeon) triangulifer* LC<sub>20</sub> Estimation****c) Hard Water****BMDS Input Table: Hill Continuous Model**

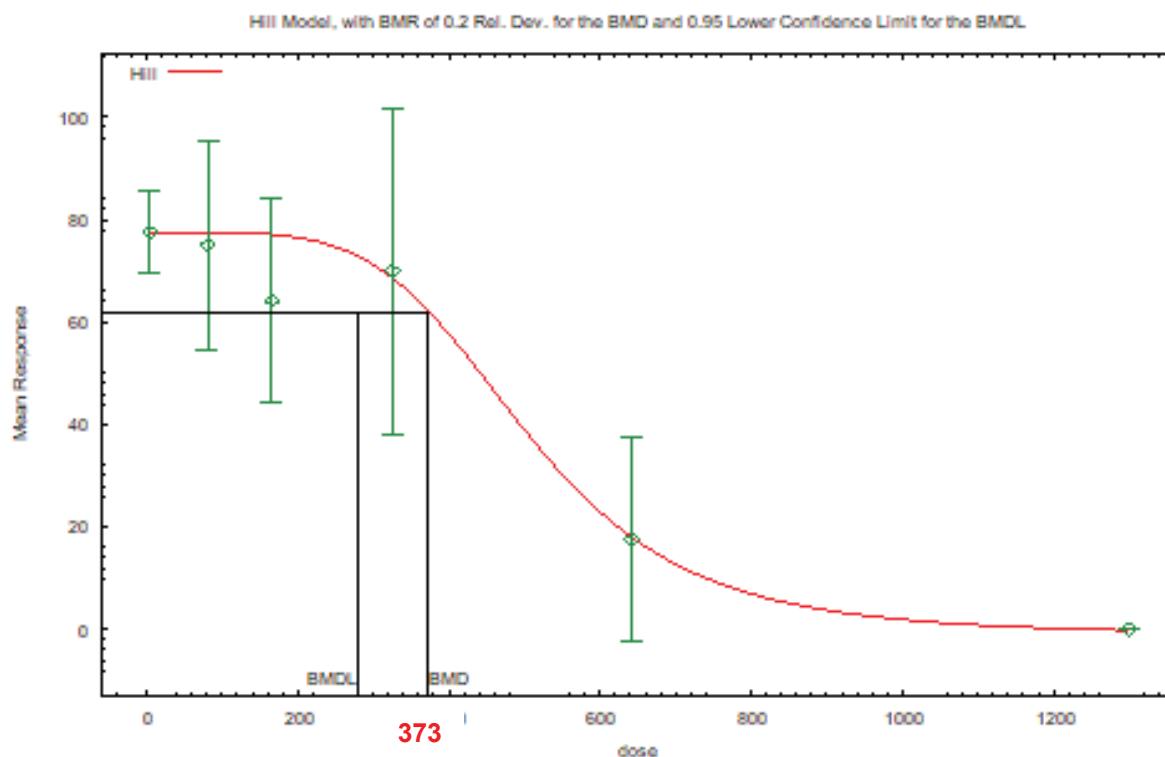
| Dose  | N  | Mean Response | St. Dev. |
|-------|----|---------------|----------|
| 1.21  | 3* | 77.5          | 8.9      |
| 78    | 4  | 75.0          | 10.0     |
| 154   | 4  | 64.2          | 16.3     |
| 326   | 4  | 70.0          | 8.2      |
| 646   | 4  | 17.5          | 5.0      |
| 1,280 | 4  | 0             | 0        |

Notes:

Dose- Chloride, mg/L; N -replicate number; mean response –survival percentage, relative to control; st.dev. – standard deviation

\*High mortality in one replicate was observed due to dropped DO (Nautilus, 2019); and this replicate was not included in the final statistics;

Original data report prepared by Nautilus (2019) is provided in the end of Appendix B.

**BMDS Output Plot: LC<sub>20</sub> = 373 mg/L**

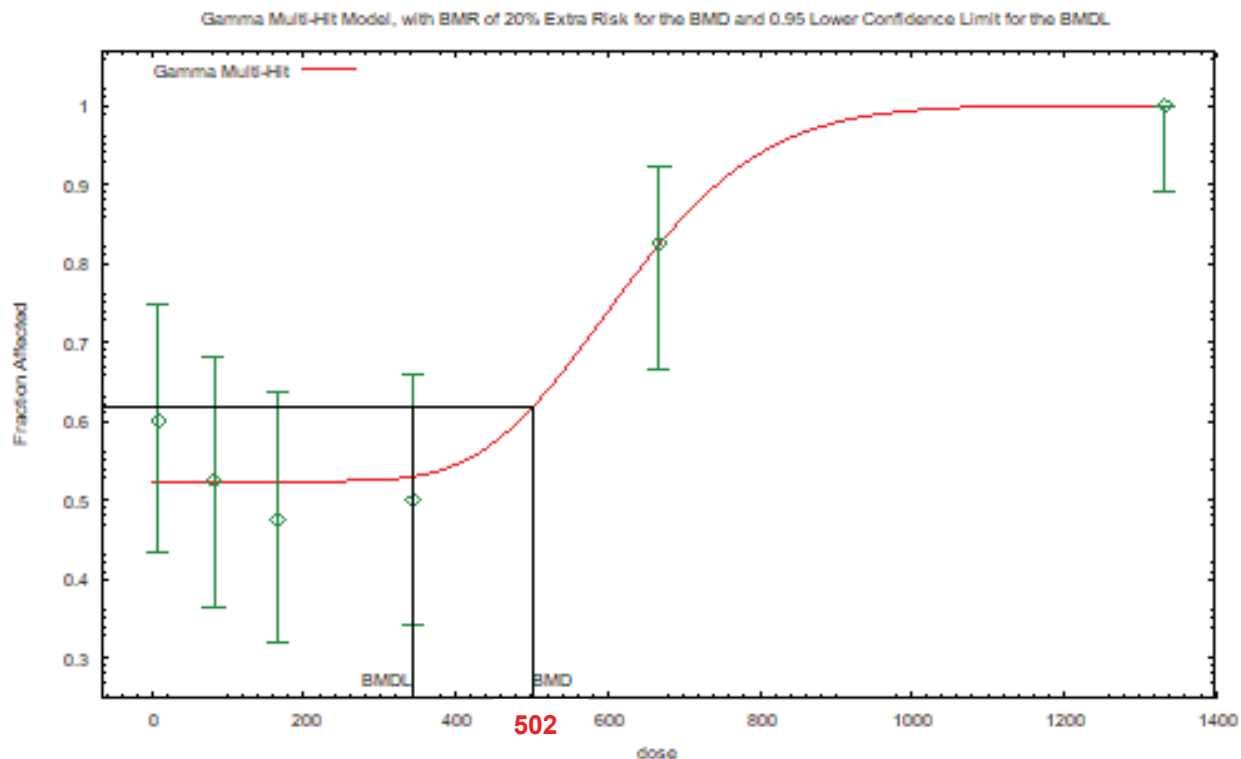
**Figure B-5.2. *Centropomus (Neocloeon) triangulifer* LC<sub>20</sub> Estimation****d) Very Hard Water****BMDS Input Table: Gamma Dichotomous Model**

| Dose | N  | Effect |
|------|----|--------|
| 8.66 | 40 | 24     |
| 81.6 | 40 | 21     |
| 166  | 40 | 19     |
| 344  | 40 | 20     |
| 668  | 40 | 33     |
| 1333 | 40 | 40     |

Notes:

Dose- Chloride, mg/L; N – number of organisms per dose, effect – number of organisms affected

Original data report prepared by Nautilus (2019) is provided in the end of Appendix B.

**BMDS Output Plot: LC<sub>20</sub> = 502 mg/L**





**An evaluation of the effect of water  
hardness on chloride toxicity using  
Northern leopard frog (*Lithobates  
pipiens*) tadpoles**

Draft Report

December 9, 2016

Submitted to: **Equilibrium Environmental Inc.**  
Calgary, AB

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This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party.

## 1.0 INTRODUCTION

Chloride generally occurs in aquatic environments as the highly soluble  $\text{Cl}^-$  ion, which is readily dissociated from major cations such as  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$ . The ion can occur at elevated concentrations in aquatic systems both naturally and due to anthropogenic activities. Anthropogenic sources of chloride include wastewater effluents, road runoff, groundwater, and application and storage of road salt (Evans and Frick, 2001; Chapra et al., 2009). High levels of chloride are of toxicological concern due to the potential to disrupt ion balance in aquatic organisms. Aquatic organisms pump ions, such as chloride, against an osmotic gradient to maintain ionic stasis in hypo-osmotic environments (Hobe et al., 1984; Perry, 1997). Therefore, increasing chloride in surface waters may affect the ability of an aquatic organism to osmoregulate, potentially affecting endocrine balance, oxygen consumption and general changes in physiological processes (Holland et al., 2010).

The potential for chronic effects of chloride on amphibians is not well understood. A study by Beak (1999) reported a 7-day  $\text{LC}_{10}$  of 1,307 mg/L using *Xenopus laevis* while Doe (2010) reported a 108-day MATC (survival) of 3,431 mg/L using *Lithobates pipiens*. This limited dataset, which does not include sublethal effects, suggests further study is required to understand the potential impact of chloride in aquatic systems. In addition, the possibility of modifying factors (e.g., water hardness) affecting chloride toxicity on amphibians should be further explored. Water hardness has been shown to decrease the acute toxicity of chloride in a freshwater water flea (*Ceriodaphnia dubia*), fingernail clams (*Sphaerium simile* and *Musculium transversum*), a worm (*Tubifex tubifex*), and a freshwater mussel (*Lampsilis siloquoidea*) (Elphick et al. 2011, Soucek et al., 2011, Gillis, 2011).

A standardized method for assessing toxicity in amphibians is currently being developed by Environment Canada for the Northern Leopard frog (*L. pipiens*, formerly *Rana pipiens*) due, in part, to its broad distribution and relevance to Canadian environments. *L. pipiens* is a green or brown frog with large spots, light coloured dorsolateral ridges and white belly. They are present in every Canadian province and territory except the Yukon and are found in a variety of habitats including prairies, woodland and tundra (Canadian Herpetological Society, 2012).

This study evaluated the toxic effect of chloride on the Northern leopard frog, *L. pipiens*, in three water types; very soft, moderately hard and very hard water. Tadpoles were exposed from an early pre-metamorphic developmental stage to the onset of metamorphosis and, in addition to

observing lethality, sublethal endpoints relating to growth and development were assessed at three time points during the exposure.

## 2.0 METHODS

Exposures were initiated using *L. pipiens* tadpoles reared from two egg masses spawned at the Nautilus Environmental laboratory (Burnaby, BC). Tadpoles were pre-metamorphic, at Gosner developmental stage 25. The organisms were visually inspected for overall health and gross deformities prior to healthy tadpoles being randomly distributed among aquaria. Tadpoles were exposed to a range of chloride treatments (151, 303, 607, 1213 2426 and 4853 mg/L) in three different water types. A control was maintained for each water type and all treatments were tested in quadruplicate. Sodium chloride was diluted in each water type to make stock solutions of 100 g/L chloride. The water types were very soft water (Metro Vancouver dechlorinated municipal tap water), synthetic moderately hard water and synthetic very hard water. The moderately hard and very hard water were prepared according to the recipe described in USEPA (2002). The approximate hardness ranges of these waters were 6-10, 80-100 and 280-320 mg/L as CaCO<sub>3</sub>, respectively. All chemical salts used in the exposures were reagent grade.

Testing conditions were adapted from draft methodology described by Environment Canada (Lo et al., 2014). The exposures were conducted in environment controlled chambers at  $23 \pm 1^\circ\text{C}$  with a photoperiod of 16 hours light: 8 hours dark and light intensity of 100-500 lux. Tadpoles were exposed in glass aquaria containing 8-L of water and each aquarium contained eight tadpoles. Water renewals were conducted three times per week and tadpoles were fed daily at a rate of 3% body weight, using Sera Micron; the food was prepared as a slurry immediately prior to feeding. Tadpoles from one replicate of the very soft water control were weighed weekly and feeding rates were adjusted accordingly. Temperature and mortality observations were recorded daily, at which time mortalities were removed.

Water renewals (75% replacement) occurred three times per week, at which time temperature, dissolved oxygen, pH and conductivity were measured before and after renewals. Ammonia was measured in a subset of test containers twice per week. Chloride was measured in all treatments six times during the exposure period, and alkalinity, sulphate, calcium, magnesium, potassium, and sodium was measured twice during the exposures in each of the three water types. Analytical chemistry was conducted by ALS Environmental (Burnaby, BC). Chloride and sulphate were measured using ion chromatography and the cations were measured using inductively coupled plasma - optical emission spectrophotometry.

Exposures continued until 50-55% of control tadpoles had reached the onset of metamorphosis (Gosner 42). Test endpoints included development stage, length, snout to vent length, biomass (replicate wet weight divided by initial number of organisms) and mortality. These endpoints were recorded at 28 days, 56 days and at exposure termination. Assessments during the exposures were conducted non-lethally. At termination, all tadpoles were euthanized using a lethal dose (4 g/L) of tricaine methanesulfonate (MS-222).

Linear interpolation was used to analyze mortality data and estimate LC20 values, since the data did not meet the statistical assumptions for probit analysis. With the exception of Gosner stage (development), exploratory analyses using linear regression were used to assess whether chloride exerted a negative sublethal effect on tadpoles. For endpoints where chloride appeared to have a significant effect, either non-linear regression (3-P log-logistic model) or linear interpolation was used to estimate IC20 values. For Gosner stage, comparisons between treatments and control were assessed using the Dunnett's model. Control tadpoles of each water type were also compared using analysis of variance to determine whether tadpole growth, development and survival were affected by different water hardness. Point estimates and comparisons were calculated using the statistical software CETIS (Tidepool Scientific Software, 2013) and JMP (SAS, 2013), respectively.

### **3.0 RESULTS AND DISCUSSION**

The exposures duration for very soft water was 85 days while moderately hard and very hard water was 89 days. Mean control survival was 87.5, 81.2 and 78.1% in very soft, moderately hard water and very hard water, respectively (Table 1). Control mortality, growth (length, snout to vent length and biomass) and development (Gosner stage) were not significantly different from one another across water types. One replicate of the 1242 mg/L chloride very hard water treatment was excluded from analyses due to suspected microbial or fungal contamination; at 28 days, tadpoles in this replicate exhibited white tail fins and lethargy. Mortality was observed and within one week following the observation of illness, all tadpoles in the replicate were dead. The same symptoms and corresponding mortality was not observed in the remaining replicates or other treatments, suggesting mortality in this replicate was independent of chloride.

Measured chloride concentrations were within 10% of nominal concentrations and mean measured chloride concentrations were used to summarize results and for statistical analyses. Total ammonia concentrations remained below 4 mg/L throughout the exposure.

The pattern of mortalities was largely similar in the three water types. Complete mortality was observed in the highest treatment (4600-4910 mg/L chloride) in all water types while survival in

the second highest treatment (2330-2426 mg/L chloride) remained above 71% (Table 1). The LC20 estimates were largely similar, indicating that water hardness did not appear to alter the effect of chloride on survival of this species (Table 2).

**Table 1.** Tadpole survival at test termination.

| Very soft          |                      | Water type<br>Moderately Hard |                      | Very Hard          |                      |
|--------------------|----------------------|-------------------------------|----------------------|--------------------|----------------------|
| Chloride<br>(mg/L) | Mean Survival<br>(%) | Chloride<br>(mg/L)            | Mean Survival<br>(%) | Chloride<br>(mg/L) | Mean Survival<br>(%) |
| 2.7                | 87.5 ± 10.2          | 4.9                           | 81.2 ± 21.6          | 10.5               | 78.1 ± 6.2           |
| 143                | 87.5 ± 14.4          | 148                           | 93.8 ± 7.2           | 162                | 84.4 ± 6.2           |
| 297                | 96.9 ± 6.2           | 306                           | 87.5 ± 17.7          | 320                | 87.5 ± 17.7          |
| 605                | 93.8 ± 12.5          | 601                           | 78.1 ± 6.2           | 614                | 84.4 ± 15.7          |
| 1204               | 71.9 ± 21.3          | 1200                          | 75.0 ± 22.8          | 1242               | 95.8 ± 7.2           |
| 2426               | 71.9 ± 6.2           | 2396                          | 87.5 ± 7.2           | 2330               | 81.2 ± 12.5          |
| 4910               | 0.0 ± 0.0            | 4600                          | 0.0 ± 0.0            | 4770               | 0.0 ± 0.0            |

**Table 2.** LC20 values for chloride in three water types.

| Water type      | LC20 (95% Confidence Limit) mg/L |                  |                  |
|-----------------|----------------------------------|------------------|------------------|
|                 | 28-day                           | 56-day           | Termination*     |
| Very soft       | 2690 (2509-2855)                 | 2652 (2532-2797) | 2471 (N/A-2683)  |
| Moderately hard | 2665 (2539-2710)                 | 2595 (2409-2749) | 2609 (N/A-2806)  |
| Very hard       | 2529 (406-2745)                  | 2523 (1498-2789) | 2600 (2015-2743) |

\*Test termination: Day 85 for very soft water and Day 89 for moderately hard and very hard water

Differences in tadpole developmental rate between chloride treatments and the controls were apparent, but changed over the course of the exposures. After 28-days of exposure, the control tadpoles in very soft water were more developed than tadpoles in all of the chloride concentrations in this water type (p-value = 0.0014, or lower). The difference between mean Gosner development stages in the control and chloride treatments was approximately 1 to 1.5 stages (Table 3). Interestingly, the controls for the moderately hard and hard water treatments were also at a lower Gosner stage than the very soft water control after 28 days of exposure. Thus, it appears that this effect (i.e., the faster developmental rate in the very soft water control) was related to the low ionic strength of the very soft water control, rather than being associated with differences in chloride concentration specifically.

In moderately hard water, tadpole development was significantly different from control in the 601 and 1200 mg/L chloride treatments (p-value = 0.0032 and 0.0009), while in very hard water, only the 1242 mg/L chloride treatment was significantly different from the control (p-value = 0.0066). As the exposures progressed, these differences in developmental stage decreased. At 56-days, only the highest chloride treatment (2426 mg/L chloride) in the very soft water was significantly different from control (p-value = 0.0021) and no significant differences were observed between control and chloride concentrations in moderately hard or very hard water. At test termination, no significant differences in development were observed in any of the water types tested. Thus, chloride may have caused a minor effect on developmental timing during the earlier stages of development. However, this effect was transient, and not likely to be of ecological consequence.

**Table 3.** Tadpole development (Gosner stage).

| Water type      | Chloride<br>(mg/L) | Mean Gosner stage $\pm$ Standard Deviation |                 |                |
|-----------------|--------------------|--------------------------------------------|-----------------|----------------|
|                 |                    | 28-days                                    | 56-days         | Termination    |
| Very soft       | 2.6                | 28.5 $\pm$ 0.3                             | 34.0 $\pm$ 0.2  | 39.6 $\pm$ 0.6 |
|                 | 143                | 27.5* $\pm$ 0.2                            | 33.4 $\pm$ 1.0  | 39.7 $\pm$ 0.7 |
|                 | 297                | 27.5* $\pm$ 0.3                            | 34.2 $\pm$ 0.2  | 39.3 $\pm$ 0.4 |
|                 | 605                | 27.2* $\pm$ 0.2                            | 33.9 $\pm$ 0.8  | 39.6 $\pm$ 1.4 |
|                 | 1204               | 27.3* $\pm$ 0.6                            | 33.1 $\pm$ 1.0  | 38.1 $\pm$ 1.9 |
|                 | 2426               | 27.0* $\pm$ 0.3                            | 31.6* $\pm$ 1.0 | 39.1 $\pm$ 0.5 |
| Moderately hard | 4.9                | 27.9 $\pm$ 0.4                             | 32.7 $\pm$ 1.2  | 39.2 $\pm$ 0.3 |
|                 | 148                | 27.3 $\pm$ 0.5                             | 32.0 $\pm$ 1.2  | 39.0 $\pm$ 1.1 |
|                 | 306                | 27.5 $\pm$ 0.4                             | 33.0 $\pm$ 0.8  | 39.4 $\pm$ 0.7 |
|                 | 601                | 26.8* $\pm$ 0.3                            | 32.6 $\pm$ 0.9  | 39.6 $\pm$ 0.9 |
|                 | 1200               | 26.6* $\pm$ 0.3                            | 32.6 $\pm$ 1.1  | 39.4 $\pm$ 1.7 |
|                 | 2396               | 27.2 $\pm$ 0.3                             | 32.5 $\pm$ 0.7  | 39.8 $\pm$ 0.4 |
| Very hard       | 10.5               | 26.5 $\pm$ 0.1                             | 32.4 $\pm$ 0.8  | 39.6 $\pm$ 2.0 |
|                 | 162                | 26.2 $\pm$ 0.2                             | 31.3 $\pm$ 0.3  | 39.5 $\pm$ 1.2 |
|                 | 320                | 26.7 $\pm$ 0.2                             | 32.3 $\pm$ 1.1  | 39.8 $\pm$ 1.0 |
|                 | 614                | 26.1 $\pm$ 0.3                             | 31.1 $\pm$ 1.4  | 39.0 $\pm$ 0.5 |
|                 | 1242               | 25.8* $\pm$ 0.3                            | 30.4 $\pm$ 1.2  | 37.2 $\pm$ 1.7 |
|                 | 2330               | 26.1 $\pm$ 0.3                             | 32.0 $\pm$ 0.9  | 38.9 $\pm$ 0.8 |

\*Significantly different from control



The effect of exposure to chloride on tadpole biomass is shown in Table 4. For all water types, the IC20 value was greater at test termination than at 28-days. Throughout the exposures, the biomass IC20 values were much higher in the moderately hard and very hard water compared to very soft water. Significant trends in tadpole length and snout to vent length were not observed in the exposures. All estimated IC20 values for the length endpoints were greater than the second highest chloride concentrations tested (2330-2426 mg/L); there was no survival in the highest concentration, and so no lengths were measured.

**Table 4.** Chloride IC20 values for tadpole biomass

| Water type      | Biomass IC20 (95% Confidence Limit) |                  |                  |
|-----------------|-------------------------------------|------------------|------------------|
|                 | 28-day                              | 56-day           | Termination*     |
| Very soft       | 476.3 (N/A-1733)                    | 1754 (N/A-3009)  | 877 (N/A-3400)   |
| Moderately hard | 2427 (N/A-2691)                     | 2669 (2271-2766) | 2688 (2385-2755) |
| Very hard       | 2402 (N/A-2782)                     | 2429 (N/A-2657)  | 2680 (2195-2694) |

\*Test termination: Day 85 for very soft water and Day 89 for moderately hard and very hard water

The data suggest that similar to invertebrates, chloride toxicity in amphibians may be ameliorated by higher hardness; however, this effect was relatively limited. Decreases in growth in this study were observed mainly in very soft water. The IC20 (biomass) values at test termination were similar in moderately hard and very hard water (2688 and 2680 mg/L chloride, respectively).

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## **APPENDIX A** – *Lithobates pipiens* survival and development data

**Table A- 1.** Mean tadpole survival

| Water type      | Chloride<br>(mg/L) | Mean survival $\pm$ Standard deviation (%) |            |         |            |             |            |
|-----------------|--------------------|--------------------------------------------|------------|---------|------------|-------------|------------|
|                 |                    | 28-days                                    |            | 56-days |            | Termination |            |
| Very soft       | 2.66               | 100.0                                      | $\pm$ 0.0  | 96.9    | $\pm$ 6.2  | 87.5        | $\pm$ 10.2 |
|                 | 143.25             | 100.0                                      | $\pm$ 0.0  | 100.0   | $\pm$ 0.0  | 87.5        | $\pm$ 14.4 |
|                 | 297.00             | 100.0                                      | $\pm$ 0.0  | 100.0   | $\pm$ 0.0  | 96.9        | $\pm$ 6.2  |
|                 | 605.20             | 100.0                                      | $\pm$ 0.0  | 93.8    | $\pm$ 7.2  | 93.8        | $\pm$ 12.5 |
|                 | 1204.00            | 96.9                                       | $\pm$ 6.2  | 96.9    | $\pm$ 6.2  | 71.9        | $\pm$ 21.3 |
|                 | 2426.00            | 93.8                                       | $\pm$ 7.2  | 90.6    | $\pm$ 6.2  | 71.9        | $\pm$ 6.2  |
|                 | 4910.00            | 0.0                                        | $\pm$ 0.0  | 0.0     | $\pm$ 0.0  | 0.0         | $\pm$ 0.0  |
| Moderately hard | 4.93               | 100.0                                      | $\pm$ 0.0  | 96.9    | $\pm$ 6.2  | 81.2        | $\pm$ 21.6 |
|                 | 148.20             | 93.8                                       | $\pm$ 7.2  | 90.6    | $\pm$ 6.2  | 93.8        | $\pm$ 7.2  |
|                 | 306.00             | 93.8                                       | $\pm$ 7.2  | 87.5    | $\pm$ 17.7 | 87.5        | $\pm$ 17.7 |
|                 | 601.00             | 96.9                                       | $\pm$ 6.2  | 81.2    | $\pm$ 7.2  | 78.1        | $\pm$ 6.2  |
|                 | 1200.00            | 96.9                                       | $\pm$ 6.2  | 90.6    | $\pm$ 12.0 | 75.0        | $\pm$ 22.8 |
|                 | 2396.00            | 96.9                                       | $\pm$ 6.2  | 93.8    | $\pm$ 7.2  | 87.5        | $\pm$ 7.2  |
|                 | 4600.00            | 0.0                                        | $\pm$ 0.0  | 0.0     | $\pm$ 0.0  | 0.0         | $\pm$ 0.0  |
| Very hard       | 10.50              | 96.9                                       | $\pm$ 6.2  | 93.8    | $\pm$ 12.5 | 78.1        | $\pm$ 6.2  |
|                 | 162.20             | 96.9                                       | $\pm$ 6.2  | 93.8    | $\pm$ 7.2  | 84.4        | $\pm$ 6.2  |
|                 | 320.00             | 90.6                                       | $\pm$ 12.0 | 90.6    | $\pm$ 12.0 | 87.5        | $\pm$ 17.7 |
|                 | 614.00             | 100.0                                      | $\pm$ 0.0  | 93.8    | $\pm$ 7.2  | 84.4        | $\pm$ 15.7 |
|                 | 1242.00            | 87.5                                       | $\pm$ 17.7 | 95.8    | $\pm$ 7.2  | 95.8        | $\pm$ 7.2  |
|                 | 2330.00            | 87.5                                       | $\pm$ 17.7 | 84.3    | $\pm$ 15.7 | 81.2        | $\pm$ 12.5 |
|                 | 4770.00            | 0.0                                        | $\pm$ 0.0  | 0.0     | $\pm$ 0.0  | 0.0         | $\pm$ 0.0  |

**Table A- 2.** Mean tadpole biomass

| Water type      | Chloride<br>(mg/L) | Mean Biomass (g) |        |         |        |             |         |
|-----------------|--------------------|------------------|--------|---------|--------|-------------|---------|
|                 |                    | 28-days          |        | 56-days |        | Termination |         |
| Very soft       | 2.66               | 0.36             | ± 0.05 | 1.21    | ± 0.24 | 2.02        | ± 0.21  |
|                 | 143.25             | 0.33             | ± 0.02 | 1.18    | ± 0.27 | 1.76        | ± 0.37  |
|                 | 297.00             | 0.29             | ± 0.02 | 1.10    | ± 0.13 | 1.69        | ± 0.14  |
|                 | 605.20             | 0.23             | ± 0.04 | 1.08    | ± 0.25 | 1.89        | ± -0.25 |
|                 | 1204.00            | 0.26             | ± 0.04 | 1.08    | ± 0.18 | 1.43        | ± 0.38  |
|                 | 2426.00            | 0.23             | ± 0.02 | 0.87    | ± 0.15 | 1.51        | ± 0.14  |
|                 | 4910.00            | 0.00             | ± 0.00 | 0.00    | ± 0.00 | 0.00        | ± 0.00  |
| Moderately hard | 4.90               | 0.31             | ± 0.03 | 0.98    | ± 0.15 | 1.41        | ± 0.38  |
|                 | 148.20             | 0.22             | ± 0.04 | 0.84    | ± 0.19 | 1.58        | ± 0.14  |
|                 | 306.00             | 0.27             | ± 0.03 | 1.09    | ± 0.25 | 1.68        | ± 0.25  |
|                 | 601.00             | 0.23             | ± 0.01 | 0.93    | ± 0.27 | 1.35        | ± 0.31  |
|                 | 1200.00            | 0.23             | ± 0.01 | 0.88    | ± 0.10 | 1.42        | ± 0.26  |
|                 | 2396.00            | 0.31             | ± 0.00 | 1.02    | ± 0.14 | 1.77        | ± 0.16  |
|                 | 4600.00            | 0.00             | ± 0.00 | 0.00    | ± 0.00 | 0.00        | ± 0.00  |
| Very hard       | 10.50              | 0.23             | ± 0.03 | 0.97    | ± 0.15 | 1.57        | ± 0.31  |
|                 | 162.20             | 0.26             | ± 0.06 | 0.98    | ± 0.15 | 1.53        | ± 0.39  |
|                 | 320.00             | 0.26             | ± 0.03 | 0.96    | ± 0.17 | 1.74        | ± 0.19  |
|                 | 614.00             | 0.20             | ± 0.03 | 0.82    | ± 0.17 | 1.62        | ± 0.20  |
|                 | 1242.00            | 0.16             | ± 0.05 | 0.76    | ± 0.21 | 1.60        | ± 0.31  |
|                 | 2330.00            | 0.23             | ± 0.04 | 0.90    | ± 0.08 | 1.62        | ± 0.06  |
|                 | 4770.00            | 0.00             | ± 0.00 | 0.00    | ± 0.00 | 0.00        | ± 0.00  |

**Table A- 3.** Mean tadpole length

| Water type      | Chloride<br>(mg/L) | Mean Length $\pm$ Standard deviation (mm) |           |         |           |             |            |
|-----------------|--------------------|-------------------------------------------|-----------|---------|-----------|-------------|------------|
|                 |                    | 28-days                                   |           | 56-days |           | Termination |            |
| Very soft       | 2.66               | 30.3                                      | $\pm$ 1.0 | 48.1    | $\pm$ 0.4 | 63.1        | $\pm$ 3.6  |
|                 | 143.25             | 29.3                                      | $\pm$ 0.9 | 45.3    | $\pm$ 3.5 | 60.2        | $\pm$ 4.3  |
|                 | 297.00             | 28.9                                      | $\pm$ 0.8 | 46.1    | $\pm$ 1.2 | 58.6        | $\pm$ 1.1  |
|                 | 605.20             | 27.8                                      | $\pm$ 1.7 | 46.6    | $\pm$ 4.1 | 61.4        | $\pm$ 4.2  |
|                 | 1204.00            | 28.0                                      | $\pm$ 1.1 | 45.5    | $\pm$ 2.7 | 60.1        | $\pm$ 5.3  |
|                 | 2426.00            | 27.0                                      | $\pm$ 1.6 | 40.9    | $\pm$ 1.9 | 60.9        | $\pm$ 3.4  |
|                 | 4910.00            |                                           |           |         |           |             |            |
| Moderately hard | 4.90               | 30.2                                      | $\pm$ 1.1 | 46.1    | $\pm$ 1.7 | 59.5        | $\pm$ 1.7  |
|                 | 148.20             | 27.4                                      | $\pm$ 2.0 | 44.0    | $\pm$ 3.4 | 57.6        | $\pm$ 2.4  |
|                 | 306.00             | 28.6                                      | $\pm$ 1.5 | 47.9    | $\pm$ 0.5 | 59.9        | $\pm$ 1.8  |
|                 | 601.00             | 27.4                                      | $\pm$ 0.7 | 47.1    | $\pm$ 2.6 | 60.4        | $\pm$ 1.3  |
|                 | 1200.00            | 26.7                                      | $\pm$ 0.4 | 42.8    | $\pm$ 2.9 | 60.1        | $\pm$ 4.7  |
|                 | 2396.00            | 29.5                                      | $\pm$ 0.8 | 44.9    | $\pm$ 3.0 | 58.2        | $\pm$ 2.0  |
|                 | 4600.00            |                                           |           |         |           |             |            |
| Very hard       | 10.50              | 26.1                                      | $\pm$ 0.5 | 45.2    | $\pm$ 4.2 | 61.6        | $\pm$ 5.1  |
|                 | 162.20             | 26.6                                      | $\pm$ 1.6 | 44.2    | $\pm$ 2.4 | 58.6        | $\pm$ 4.6  |
|                 | 320.00             | 28.3                                      | $\pm$ 0.5 | 44.7    | $\pm$ 1.6 | 61.0        | $\pm$ 3.7  |
|                 | 614.00             | 26.7                                      | $\pm$ 1.0 | 42.0    | $\pm$ 1.3 | 59.5        | $\pm$ 2.2  |
|                 | 1242.00            | 25.3                                      | $\pm$ 3.2 | 39.8    | $\pm$ 3.3 | 41.4        | $\pm$ 27.7 |
|                 | 2330.00            | 27.3                                      | $\pm$ 1.7 | 43.6    | $\pm$ 5.6 | 59.8        | $\pm$ 3.6  |
|                 | 4700.00            |                                           |           |         |           |             |            |

**Table A- 4.** Mean tadpole snout to vent length

| Water type      | Chloride<br>(mg/L) | Mean snout to vent length $\pm$ Standard deviation (mm) |            |         |           |             |           |
|-----------------|--------------------|---------------------------------------------------------|------------|---------|-----------|-------------|-----------|
|                 |                    | 28-days                                                 |            | 56-days |           | Termination |           |
| Very soft       | 2.66               | 10.64                                                   | $\pm$ 0.03 | 16.7    | $\pm$ 1.9 | 21.6        | $\pm$ 0.9 |
|                 | 143.25             | 9.69                                                    | $\pm$ 0.05 | 17.5    | $\pm$ 1.8 | 21.0        | $\pm$ 1.3 |
|                 | 297.00             | 9.67                                                    | $\pm$ 0.03 | 17.4    | $\pm$ 0.7 | 19.7        | $\pm$ 0.5 |
|                 | 605.20             | 9.41                                                    | $\pm$ 0.08 | 16.7    | $\pm$ 2.4 | 20.4        | $\pm$ 1.2 |
|                 | 1204.00            | 9.22                                                    | $\pm$ 0.04 | 17.2    | $\pm$ 1.5 | 20.2        | $\pm$ 2.2 |
|                 | 2426.00            | 9.30                                                    | $\pm$ 0.03 | 15.6    | $\pm$ 1.4 | 20.7        | $\pm$ 0.6 |
|                 | 4910.00            |                                                         |            |         |           |             |           |
| Moderately hard | 4.90               | 10.0                                                    | $\pm$ 0.6  | 16.6    | $\pm$ 1.3 | 19.6        | $\pm$ 1.7 |
|                 | 148.20             | 9.5                                                     | $\pm$ 0.7  | 16.2    | $\pm$ 1.8 | 19.8        | $\pm$ 0.5 |
|                 | 306.00             | 10.0                                                    | $\pm$ 0.4  | 17.9    | $\pm$ 1.2 | 19.8        | $\pm$ 0.6 |
|                 | 601.00             | 9.3                                                     | $\pm$ 0.2  | 16.5    | $\pm$ 1.5 | 19.7        | $\pm$ 0.6 |
|                 | 1200.00            | 9.4                                                     | $\pm$ 0.4  | 15.2    | $\pm$ 1.7 | 20.3        | $\pm$ 1.7 |
|                 | 2396.00            | 10.2                                                    | $\pm$ 0.5  | 16.5    | $\pm$ 1.1 | 20.6        | $\pm$ 0.5 |
|                 | 4600.00            |                                                         |            |         |           |             |           |
| Very hard       | 10.50              | 9.3                                                     | $\pm$ 0.2  | 16.5    | $\pm$ 2.1 | 20.6        | $\pm$ 1.0 |
|                 | 162.20             | 9.5                                                     | $\pm$ 0.6  | 15.6    | $\pm$ 0.9 | 19.9        | $\pm$ 2.3 |
|                 | 320.00             | 13.0                                                    | $\pm$ 6.0  | 15.4    | $\pm$ 0.9 | 20.3        | $\pm$ 1.4 |
|                 | 614.00             | 8.9                                                     | $\pm$ 0.4  | 14.4    | $\pm$ 0.7 | 20.3        | $\pm$ 1.6 |
|                 | 1242.00            | 8.9                                                     | $\pm$ 0.7  | 13.8    | $\pm$ 1.1 | 13.7        | $\pm$ 9.2 |
|                 | 2330.00            | 9.4                                                     | $\pm$ 0.7  | 15.2    | $\pm$ 2.1 | 20.1        | $\pm$ 1.7 |
|                 | 4700.00            |                                                         |            |         |           |             |           |



## **APPENDIX B – Major ion chemistry**



**END OF REPORT**



# Effect of Water Hardness on Toxicity of Chloride to *Neocloen triangulifer*

Final Report

June 6, 2019

Submitted to: **Equilibrium Environmental Inc.**  
Calgary, AB

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APPENDIX C – Hard Water Toxicity Test Data

APPENDIX D – Very Hard Water Toxicity Test Data

APPENDIX E – Analytical Data

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**SIGNATURE PAGE**

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This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party. The results presented here relate only to the samples tested.

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## 1.0 INTRODUCTION

The objective of this work was to test the effect of water hardness on toxicity of chloride, introduced as sodium chloride (NaCl), to a mayfly, *Neocloen triangulifer*. Testing was performed across a range of chloride concentrations and hardness levels over a 28-day period.

## 2.0 METHODS

### Culturing

Mayfly eggs (*N. triangulifer*) were obtained from the University of Illinois and received on July 12, 2018. The eggs were cultured based on methods published by Weaver et al. (2015) and Soucek et al. (2015), and were raised to sexual maturity. Upon reaching the imago stage, mayflies were gently grasped by the wings with forceps and the ventral surfaces of their abdomens were held to the water surface in plastic vials filled with dechlorinated City of Calgary tap water to elicit the release of eggs. The vials were stored in the dark at  $10 \pm 2^\circ\text{C}$  until a sufficient number of eggs was collected to initiate testing, at which time they were transferred into an environmental chamber and maintained at  $25 \pm 2^\circ\text{C}$  to initiate hatching. The photoperiod of the chamber was 16 hours of light and 8 hours of darkness. The vials were checked daily for hatching and any hatched organisms were transferred to a 1-L jar containing 500 mL of culture water.

Newly-hatched mayflies were fed a diet of mixed diatom species comprised of *Synedra* sp. and *Navicula* sp., prepared from a starter culture obtained from Merlan Scientific (Mississauga, ON). Diatoms were fed diatoms that were loose, or as a biofilm grown on a frosted slide, in the first two weeks of culturing. The slides were replaced as they became denuded.

### Preparation of treatments

Four water hardness treatments (soft, moderately hard, hard, and very hard) used as dilution waters for various chloride treatments were prepared in 200-L plastic drums. Dilution water formulations were based on USEPA reconstituted water recipes (US EPA, 2002) to allow for comparison with other published toxicity testing data. For each dilution water, the chemicals listed in Table 1 were added to 180 L of deionized reverse osmosis (DRO) water and aerated for 5-6 days at testing temperature. Each dilution water was subsequently analyzed for hardness and alkalinity prior to preparing chloride treatments (Table 2). Five chloride concentrations (75, 150, 300, 600 and 1200 mg/L) were prepared in each water type, for a total of twenty treatments.



**Table 1. Chemicals additions for preparation of the four dilution waters.**

|                              | Amount (g) added to 180 L of deionized water |                                      |                                      |      |
|------------------------------|----------------------------------------------|--------------------------------------|--------------------------------------|------|
|                              | NaHCO <sub>3</sub>                           | CaSO <sub>4</sub> ·2H <sub>2</sub> O | MgSO <sub>4</sub> ·7H <sub>2</sub> O | KCl  |
| <b>Soft Water</b>            | 8.6                                          | 5.4                                  | 11.1                                 | 0.36 |
| <b>Moderately Hard Water</b> | 17.3                                         | 10.8                                 | 22.1                                 | 0.72 |
| <b>Hard Water</b>            | 34.6                                         | 21.6                                 | 44.2                                 | 1.44 |
| <b>Very Hard Water</b>       | 69.1                                         | 43.2                                 | 88.5                                 | 2.88 |

**Table 2. Measured hardness and alkalinity concentrations for the four prepared dilution waters**

|                              | Hardness (mg/L as CaCO <sub>3</sub> ) | Alkalinity (mg/L as CaCO <sub>3</sub> ) |
|------------------------------|---------------------------------------|-----------------------------------------|
| <b>Soft Water</b>            | 42                                    | 54                                      |
| <b>Moderately Hard Water</b> | 84                                    | 85                                      |
| <b>Hard Water</b>            | 168                                   | 135                                     |
| <b>Very Hard Water</b>       | 292                                   | 164                                     |

## Testing

The testing conditions are summarized in Table 3. Test initiations for the four water hardness treatments were staggered to accommodate variability in the hatching times of the mayfly eggs, as only organisms <48 hours old were used in testing. Testing of all chloride concentrations for a given hardness treatment were initiated on the same day.

Four replicates were established for each treatment containing 10 organisms in 100 mL of test solution in a 120 mL glass jar, along with one slide containing diatom biofilm and 0.5 mL of a concentrated diatom slurry, as described previously for culturing. Organisms were fed daily with 0.5 mL of concentrated diatom slurry.

No water exchanges were performed during the first four days to minimize disturbances to the organisms. During the first water renewal, the organisms were transferred to 1-L jars, each containing 500 mL of test solution. Water exchanges were subsequently performed three times per week, with pH, conductivity, dissolved oxygen and temperature measured in both the freshly-prepared and old solutions. Survival was recorded daily and observations made related to the life-stage of the test organisms. The biofilm slides were changed at each water exchange unless a

slide was visually denuded during daily observations, in which case it was changed at the time of observation. After 11 to 13 days of exposure, the slides were replaced each day. Gentle aeration was performed if the dissolved oxygen levels dropped to  $\leq 80\%$  saturation.

Once organisms formed black wing pads, they were transferred to 120-mL jars of solution that were then placed into larger empty covered beakers to allow for emergence. The mayflies transitioned from nymph, to subimago, to imago stages within a 24-hour period. Once emerged in the imago stage, the mayflies were collected with forceps into a vial and frozen. The mayflies were subsequently dried and weighed; weights were only determined for the emerged mayflies. Testing was terminated after 28 days of exposure; any organisms with black wing pads were placed into an emergence jar for collection the following day and were included in the statistical analyses. Statistical analyses were performed using CETIS (Tidepool Scientific Software, version 1.9.4).

At test initiation and termination, each dilution water was analyzed for sodium, potassium, calcium, magnesium, sulfate and chloride concentrations, and each treatment was analyzed for chloride concentration (data provided in Appendix B).

**Table 3. Summary of test conditions for the 28-d mayfly test**

|                                 |                                                                                                                                                                         |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test organism                   | <i>Neocloeon triangulifer</i>                                                                                                                                           |
| Test organism source            | Cultured in house with eggs obtained from the University of Illinois                                                                                                    |
| Organism age at test initiation | <48hrs old                                                                                                                                                              |
| Test type                       | Static-renewal                                                                                                                                                          |
| Test duration                   | 28 days                                                                                                                                                                 |
| Test vessel                     | 120-mL glass jar; 1-L glass jar                                                                                                                                         |
| Test volume                     | 100 mL; 500 mL                                                                                                                                                          |
| Test treatments                 | 4 hardness treatments; soft water, moderately hard water, hard water, very hard water (US EPA, 2002)                                                                    |
| Test concentrations             | 75, 150, 300, 600 and 1200 mg/L Cl, unamended water controls (for each hardness treatment)                                                                              |
| Test replicates                 | 4 replicates per treatment                                                                                                                                              |
| Number of organisms             | 10 per replicate                                                                                                                                                        |
| Dilution water                  | Reconstituted deionized reverse osmosis water                                                                                                                           |
| Test solution renewal           | Three times per week                                                                                                                                                    |
| Test temperature                | 25 ± 2°C                                                                                                                                                                |
| Feeding                         | Fed a combination of two diatoms species ( <i>Navicula</i> sp. and <i>Synedra</i> sp.) administered as a slurry and/or as a biofilm grown on a frosted microscope slide |
| Photoperiod                     | 16 hours light, 8 hours dark                                                                                                                                            |
| Aeration                        | None, unless dissolved oxygen dropped below 80% saturation                                                                                                              |
| Statistical software            | CETIS 1.9.4                                                                                                                                                             |
| Test endpoints                  | Survival, emergence, dry weight (of emerged organisms)                                                                                                                  |

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### 3.0 RESULTS

Due to a significant decrease in dissolved oxygen on day 14 of exposure in one replicate of the soft water control, and a corresponding incidence of mortality in that replicate, this replicate was excluded from the statistical analyses.

Survival in the controls was 69.3, 87.5, 77.5 and 40.0% in the soft, moderately hard, hard and very hard waters, respectively. Almost all of the surviving organisms successfully emerged in the control water associated with the soft, moderately hard and hard water types, whereas only 81% of the surviving mayflies emerged in the very hard control water. Thus, the test organisms did not perform as well in the high ionic strength associated with the very hard water. Point estimates reported here for the very hard water exposures should be considered with caution since they may be impaired by the generally poor performance of the test organisms in that water.

Test endpoints were calculated using measured chloride concentrations and are shown in Tables 4 through 7. For survival, the LC50 values in the soft, moderately hard, hard and very hard waters were 427, 375, 516 and 587 mg/L Cl, respectively, and the corresponding EC50 values for emergence were 390, 353, 276 and 194 mg/L Cl, respectively. No dose response was observed for dry weight, therefore endpoints were reported as greater than the highest concentration for which emergence was observed.

There was relatively minimal divergence between the dose-response curves, indicating that any effect of hardness on toxicity in these four water types was relatively small.

**Table 4. Survival, emergence, and dry weights of mayflies exposed to various chloride concentrations prepared in soft water.**

| <b>Chloride Concentration<br/>(mg/L)</b> | <b>Survival (%)</b> | <b>Emergence (%)<sup>1</sup></b> | <b>Dry Weight<br/>(Mean ± SD)</b> |
|------------------------------------------|---------------------|----------------------------------|-----------------------------------|
| 1.21 (Control)                           | 69.3 ± 8.9          | 69.3 ± 8.9                       | 0.53 ± 0.09                       |
| 78                                       | 65.0 ± 10.0         | 60.0 ± 0.0                       | 0.41 ± 0.03                       |
| 154                                      | 67.8 ± 16.3         | 65.3 ± 16.6                      | 0.47 ± 0.10                       |
| 326                                      | 60.0 ± 8.2          | 52.5 ± 9.6                       | 0.46 ± 0.10                       |
| 646                                      | 2.5 ± 5.0           | 0.0 ± 0.0                        | 0.00 ± 0.00                       |
| 1280                                     | 0.0 ± 0.0           | 0.0 ± 0.0                        | 0.00 ± 0.00                       |
| <b>Test endpoint (% v/v)</b>             |                     |                                  |                                   |
| LC50 (95% CL)                            | 427 (390-466)       | --                               | --                                |
| LC25 (95% CL)                            | 360 (266 – 400)     | --                               | --                                |
| EC50 (95% CL)                            | --                  | 390 (345 – 441)                  | --                                |
| EC25 (95% CL)                            | --                  | 330 (138 – 390)                  | --                                |
| IC50                                     | --                  | --                               | >326 <sup>3</sup>                 |
| IC25                                     | --                  | --                               | >326 <sup>3</sup>                 |

LC = Lethal Concentration, EC = Effective Concentration; IC = Inhibition Concentration CL=Confidence Limit, SD=Standard Deviation

<sup>1</sup>Emergence was calculated as the number of organisms that transitioned to the imago stage divided by the number of organisms that were initially loaded

<sup>2</sup>Dry weight was calculated as the dry weight per organism of the emerged organisms only (mg)

<sup>3</sup>Due to a lack of a normal dose response, the IC25 and IC50 values for dry weight are reported as greater than the highest concentration for which emergence was observed

**Table 5. Survival, emergence, and dry weights of mayflies exposed to various chloride concentrations prepared in moderately hard water**

| <b>Chloride Concentration<br/>(mg/L)</b> | <b>Survival (%)</b> | <b>Emergence (%)<sup>1</sup></b> | <b>Dry Weight<br/>(Mean ± SD)</b> |
|------------------------------------------|---------------------|----------------------------------|-----------------------------------|
| 2.25 (Control)                           | 87.5 ± 5.0          | 87.5 ± 5.0                       | 0.47 ± 0.09                       |
| 78.0                                     | 80.0 ± 8.2          | 77.5 ± 5.0                       | 0.48 ± 0.08                       |
| 154                                      | 62.5 ± 5.0          | 60.0 ± 8.2                       | 0.46 ± 0.04                       |
| 324                                      | 56.4 ± 4.8          | 53.4 ± 9.5                       | 0.57 ± 0.08                       |
| 640                                      | 17.5 ± 9.6          | 17.5 ± 9.6                       | 0.83 ± 0.16                       |
| 1280                                     | 0.0 ± 0.0           | 0.0 ± 0.0                        | 0.00 ± 0.00                       |
| <b>Test endpoint (% v/v)</b>             |                     |                                  |                                   |
| LC50 (95% CL)                            | 375 (252 – 473)     | --                               | --                                |
| LC25 (95% CL)                            | 215 (107 – 302)     | --                               | --                                |
| EC50 (95% CL)                            | --                  | 353 (232 – 452)                  | --                                |
| EC25 (95% CL)                            | --                  | 192 (92 – 276)                   | --                                |
| IC50                                     | --                  | --                               | >640 <sup>3</sup>                 |
| IC25                                     | --                  | --                               | >640 <sup>3</sup>                 |

LC = Lethal Concentration, EC = Effective Concentration; IC = Inhibition Concentration CL=Confidence Limit, SD=Standard Deviation

<sup>1</sup>Emergence was calculated as the number of organisms that transitioned to the imago stage divided by the number of organisms that were initially loaded

<sup>2</sup>Dry weight was calculated as the dry weight per organism of the emerged organisms only (mg)

<sup>3</sup>Due to a lack of a normal dose response, the IC25 and IC50 values for dry weight are reported as greater than the highest concentration for which emergence was observed

**Table 6. Survival, emergence, and dry weights of mayflies exposed to various chloride concentrations prepared in hard water.**

| <b>Chloride Concentration<br/>(mg/L)</b> | <b>Survival (%)</b> | <b>Emergence (%)<sup>1</sup></b> | <b>Dry Weight<br/>(Mean ± SD)</b> |
|------------------------------------------|---------------------|----------------------------------|-----------------------------------|
| 4.44 (Control)                           | 77.5 ± 5.0          | 75.0 ± 5.8                       | 0.38 ± 0.11                       |
| 81                                       | 75.0 ± 12.9         | 57.5 ± 9.6                       | 0.42 ± 0.08                       |
| 166                                      | 64.2 ± 12.6         | 44.7 ± 18.6                      | 0.54 ± 0.16                       |
| 325                                      | 70.0 ± 20.0         | 38.1 ± 11.6                      | 0.72 ± 0.24                       |
| 642                                      | 17.5 ± 12.6         | 2.5 ± 5.0                        | 0.90 ± 0.00                       |
| 1300                                     | 0.0 ± 0.0           | 0.0 ± 0.0                        | 0.00 ± 0.00                       |
| <b>Test endpoint (% v/v)</b>             |                     |                                  |                                   |
| LC50 (95% CL)                            | 516 (335 – 600)     | --                               | --                                |
| LC25 (95% CL)                            | 419 (179 – 508)     | --                               | --                                |
| EC50 (95% CL)                            | --                  | 276 (147 – 364)                  | --                                |
| EC25 (95% CL)                            | --                  | 159 (52 – 240)                   | --                                |
| IC50                                     | --                  | --                               | >642 <sup>3</sup>                 |
| IC25                                     | --                  | --                               | >642 <sup>3</sup>                 |

LC = Lethal Concentration, EC = Effective Concentration; IC = Inhibition Concentration CL=Confidence Limit, SD=Standard Deviation

<sup>1</sup>Emergence was calculated as the number of organisms that transitioned to the imago stage divided by the number of organisms that were initially loaded

<sup>2</sup>Dry weight was calculated as the dry weight per organism of the emerged organisms only (mg)

<sup>3</sup>Due to a lack of a normal dose response, the IC25 and IC50 values for dry weight are reported as greater than the highest concentration for which emergence was observed

**Table 7. Survival, emergence, and dry weights of mayflies exposed to various chloride concentrations prepared in very hard water.**

| <b>Chloride Concentration<br/>(mg/L)</b> | <b>Survival (%)</b> | <b>Emergence (%)<sup>1</sup></b> | <b>Dry Weight<br/>(Mean ± SD)</b> |
|------------------------------------------|---------------------|----------------------------------|-----------------------------------|
| 8.66 (Control)                           | 40.0 ± 14.1         | 32.5 ± 15.0                      | 0.52 ± 0.09                       |
| 81.6                                     | 45.0 ± 12.9         | 37.5 ± 9.6                       | 0.64 ± 0.13                       |
| 166                                      | 52.5 ± 9.6          | 22.5 ± 5.0                       | 0.60 ± 0.13                       |
| 344                                      | 50.0 ± 21.6         | 2.5 ± 5.0                        | 0.95 ± 0.00                       |
| 668                                      | 17.5 ± 9.6          | 0.0 ± 0.0                        | 0.00 ± 0.00                       |
| 1333                                     | 0.0 ± 0.0           | 0.0 ± 0.0                        | 0.00 ± 0.00                       |
| <b>Test endpoint (% v/v)</b>             |                     |                                  |                                   |
| LC50 (95% CL)                            | 587 (519 – 664)     | --                               | --                                |
| LC25 (95% CL)                            | CNC <sup>3</sup>    | --                               | --                                |
| EC50 (95% CL)                            | --                  | 195 (56 – 256)                   | --                                |
| EC25 (95% CL)                            | --                  | 146 (18 – 207)                   | --                                |
| IC50 (95% CL)                            | --                  | --                               | >344 <sup>4</sup>                 |
| IC25 (95% CL)                            | --                  | --                               | >344 <sup>4</sup>                 |

LC = Lethal Concentration, EC = Effective Concentration; IC = Inhibition Concentration CL=Confidence Limit, SD=Standard Deviation

<sup>1</sup>Emergence was calculated as the number of organisms that transitioned to the imago stage divided by the number of organisms that were initially loaded

<sup>2</sup>Dry weight was calculated as the dry weight per organism of the emerged organisms only (mg)

<sup>3</sup>CNC=could not calculate. Due to an abnormal dose response, no model was able to accurately fit the data

<sup>4</sup>Due to a lack of a normal dose response, the IC25 and IC50 values for dry weight are reported as greater than the highest concentration for which emergence was observed



---

## 4.0 REFERENCES

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## **APPENDIX A – Soft Water Toxicity Test Data**

---

Water Type

Soft  
Water  
(SW)

Client:

Equilibrium

Sample Reference:

SP1718-015

| Date       | Day | Initials | Chem Cart | Fed           | Daily Data Review |
|------------|-----|----------|-----------|---------------|-------------------|
| 2018/08/28 | 0   | MLIST    | 3         | 1 slide 2mL   | ML                |
| 2018/08/29 | 1   | ST       | 3         | 2mL           | FP                |
| 2018/08/30 | 2   | ST       | 3         | -             | ML                |
| 2018/08/31 | 3   | ST       | 3         | 0.5mL         | FP                |
| 2018/09/01 | 4   | ST       | 3         | -             | SS                |
| 2018/09/02 | 5   | ML       | 3         | 0.5mL         | LC                |
| 2018/09/03 | 6   | ML       | 3         | 1 slide 1.5mL | KL                |
| 2018/09/04 | 7   | ML       | 3         | 2mL           | ML                |
| 2018/09/05 | 8   | ST/ML    | 3         | 1mL           | ML                |
| 2018/09/06 | 9   | ST       | 2         | 1mL           | ML                |
| 2018/09/07 | 10  | ST       | 2         | 1mL + slide   | UF                |
| 2018/09/08 | 11  | ST       | 2         | 1mL           | UF                |
| 2018/09/09 | 12  | ML       | 3         | 2mL           | KL                |
| 2018/09/10 | 13  | ML       | 2         | 2mL + slide   | KL                |
| 2018/09/11 | 14  | ML/CB    | 2         | 1 slide 2mL   | ST                |
| 2018/09/12 | 15  | ST/ML    | 2         | 1 slide       | SS                |
| 2018/09/13 | 16  | ST/CB    | 2         | 1.5 mL        | FP                |
| 2018/09/14 | 17  | ST/CB    | 2         |               | FP                |
| 2018/09/15 | 18  | ST       | 2         |               | FP                |
| 2018/09/16 | 19  | CB       | 3         |               | CB                |
| 2018/09/17 | 20  | ST       | 3         |               | CB                |
| 2018/09/18 | 21  | ML/ST    | 3         |               | FP                |
| 2018/09/19 | 22  | ML/ST    | 2         |               | UF                |
| 2018/09/20 | 23  | ML/ST    | 3         |               | KL                |
| 2018/09/21 | 24  | ML/ST    | 2         |               | UF                |
| 2018/09/22 | 25  | ML       | 2         |               | KL                |
| 2018/09/23 | 26  | ML/ST    | 2         |               | CB                |
| 2018/09/24 | 27  | ST       | 2         |               | FP                |
| 2018/09/25 | 28  | ST/ML    | 2         |               | KL                |

\* transferred to 1L jars

put on slight aeration

\* put on slight aeration

FP aerated

Reviewed By:

MLIST

Date Reviewed:

2018/10/22 -  
2018/11/02

Water Type: SW Client: Equilibrium Sample Reference: SP1718-015

**Water Chemistries**

| conc. (mg/L Cl) | Control       | 75 | 150 | 300 | 600 | 1200 |
|-----------------|---------------|----|-----|-----|-----|------|
| day             | New Solutions |    |     |     |     |      |

pH  
(units)

|    |     |     |     |     |     |     |
|----|-----|-----|-----|-----|-----|-----|
| 0  | 7.2 | 7.5 | 7.6 | 7.6 | 7.7 | 7.7 |
| 6  | 7.8 | 7.8 | 7.7 | 7.7 | 7.7 | 7.7 |
| 8  | 7.7 | 7.6 | 7.6 | 7.6 | 7.6 | 7.6 |
| 10 | 7.9 | 7.9 | 7.9 | 7.8 | 7.8 | 7.8 |
| 13 | 7.5 | 7.6 | 7.6 | 7.6 | 7.6 | 7.6 |
| 15 | 7.0 | 7.4 | 7.4 | 7.5 | 7.5 | 7.5 |
| 17 | 7.9 | 7.9 | 7.9 | 7.8 | 7.8 | 7.8 |
| 20 | 7.9 | 7.9 | 7.8 | 7.8 | 7.8 | 7.8 |
| 22 | 8.1 | 8.0 | 7.9 | 7.8 | 7.8 | 7.8 |
| 24 | 8.3 | 8.1 | 8.0 | 8.3 | 8.0 | 8.0 |
| 27 | 7.3 | 7.5 | 7.5 | 7.6 | 7.6 | 7.6 |

EC  
(uS/cm)

|    |     |     |     |      |      |      |
|----|-----|-----|-----|------|------|------|
| 0  | 13  | 389 | 608 | 1091 | 200  | 3720 |
| 6  | 212 | 426 | 672 | 1170 | 1937 | 4090 |
| 8  | 231 | 428 | 670 | 1145 | 2130 | X    |
| 10 | 185 | 425 | 553 | 1158 | 2140 |      |
| 13 | 174 | 441 | 691 | 1185 | 2230 |      |
| 15 | 183 | 409 | 654 | 1118 | 2090 |      |
| 17 | 173 | 439 | 677 | 1200 | 2250 |      |
| 20 | 201 | 490 | 742 | 1291 | 2380 |      |
| 22 | 219 | 397 | 637 | 1070 | 1940 |      |
| 24 | 189 | 405 | 635 | 1096 | 1872 |      |
| 27 | 176 | 409 | 655 | 1109 | 1989 |      |

Reviewed By: NL/ST

Date Reviewed: 2018/11/22  
-2018/11/02



Water Type: SW Client: Equilibrium Sample Reference: SP1718-015

**Water Chemistries**

| conc. (mg/L Cl) | Control       | 75 | 150 | 300 | 600 | 1200 |
|-----------------|---------------|----|-----|-----|-----|------|
| day             | New Solutions |    |     |     |     |      |

|              |    |      |     |     |     |     |     |
|--------------|----|------|-----|-----|-----|-----|-----|
| DO<br>(mg/L) | 0  | 7.35 | 7.3 | 7.4 | 7.4 | 7.2 | 7.3 |
|              | 6  | 7.8  | 7.7 | 7.7 | 7.7 | 7.7 | 7.7 |
|              | 8  | 7.8  | 7.7 | 7.7 | 7.6 | 7.6 | X   |
|              | 10 | 7.4  | 7.4 | 7.4 | 7.5 | 7.6 |     |
|              | 13 | 7.4  | 7.4 | 7.4 | 7.4 | 7.4 |     |
|              | 15 | 7.4  | 7.4 | 7.4 | 7.4 | 7.4 |     |
|              | 17 | 7.4  | 7.4 | 7.5 | 7.5 | 7.5 |     |
|              | 20 | 7.4  | 7.4 | 7.4 | 7.4 | 7.4 |     |
|              | 22 | 7.3  | 7.3 | 7.3 | 7.3 | 7.4 |     |
|              | 24 | 7.4  | 7.4 | 7.3 | 7.3 | 7.3 |     |
|              | 27 | 7.2  | 7.2 | 7.2 | 7.2 | 7.2 |     |
|              |    |      |     |     |     |     |     |
|              |    |      |     |     |     |     |     |

|              |    |      |    |    |    |    |    |
|--------------|----|------|----|----|----|----|----|
| Temp<br>(°C) | 0  | 24.2 | 23 | 23 | 23 | 23 | 23 |
|              | 6  | 22.3 | 23 | 23 | 23 | 23 | 23 |
|              | 8  | 23   | 23 | 23 | 23 | 23 | X  |
|              | 10 | 23   | 23 | 23 | 23 | 23 |    |
|              | 13 | 23   | 23 | 23 | 23 | 23 |    |
|              | 15 | 23   | 23 | 23 | 23 | 23 |    |
|              | 17 | 23   | 23 | 23 | 23 | 23 |    |
|              | 20 | 23   | 23 | 23 | 23 | 23 |    |
|              | 22 | 23   | 23 | 23 | 23 | 23 |    |
|              | 24 | 23   | 23 | 23 | 23 | 23 |    |
|              | 27 | 23   | 23 | 23 | 23 | 23 |    |
|              |    |      |    |    |    |    |    |
|              |    |      |    |    |    |    |    |

Reviewed By: MLST

Date Reviewed: 2018/10/22 - 2018/11/02

Water Type: SW Client: Equilibrium Sample Reference: SP1718-015

**Water Chemistries**

| conc. (mg/L Cl) | Control       | 75 | 150 | 300 | 600 | 1200 |
|-----------------|---------------|----|-----|-----|-----|------|
| day             | Old Solutions |    |     |     |     |      |

pH  
(units)

|    |     |     |     |     |     |     |
|----|-----|-----|-----|-----|-----|-----|
| 6  | 7.5 | 7.6 | 7.7 | 7.8 | 7.9 | 7.9 |
| 8  | 6.5 | 7.4 | 7.6 | 7.7 | 7.7 | X   |
| 10 | 7.7 | 7.8 | 7.8 | 7.8 | 7.8 |     |
| 13 | 8.3 | 8.3 | 8.2 | 8.2 | 8.0 |     |
| 15 | 8.2 | 8.2 | 8.1 | 8.0 | 7.9 |     |
| 17 | 7.9 | 7.9 | 7.8 | 7.8 | 7.9 |     |
| 20 | 7.8 | 7.7 | 7.7 | 7.7 | 7.8 |     |
| 22 | 7.5 | 7.7 | 7.8 | 7.8 | 7.8 |     |
| 24 | 7.4 | 7.6 | 7.7 | 7.7 | 7.7 |     |
| 27 | 8.0 | 7.8 | 7.8 | 7.8 | 7.7 |     |
|    |     |     |     |     |     |     |
|    |     |     |     |     |     |     |
|    |     |     |     |     |     |     |
|    |     |     |     |     |     |     |

8.0

EC  
(uS/cm)

|    |     |     |     |      |      |      |
|----|-----|-----|-----|------|------|------|
| 6  | 228 | 411 | 665 | 1112 | 1921 | 3820 |
| 8  | 255 | 423 | 671 | 1140 | 2110 | X    |
| 10 | 233 | 431 | 582 | 1165 | 2130 |      |
| 13 | 214 | 477 | 696 | 1145 | 2040 |      |
| 15 | 237 | 439 | 645 | 1109 | 2100 |      |
| 17 | 233 | 450 | 681 | 1155 | 2200 |      |
| 20 | 238 | 542 | 757 | 1287 | 2430 |      |
| 22 | 218 | 503 | 764 | 1321 | 2600 |      |
| 24 | 216 | 463 | 688 | 1196 | 2180 |      |
| 27 | 248 | 442 | 668 | 1117 | 1999 |      |
|    |     |     |     |      |      |      |
|    |     |     |     |      |      |      |
|    |     |     |     |      |      |      |
|    |     |     |     |      |      |      |

\*See daily observations for DO and Temp of old solutions (taken daily)

Reviewed By: MLST

Date Reviewed: 20181022

20181102



Water Type

SW

Client:

Equilibrium

Sample Reference: SP1718-015

**DAILY TEST OBSERVATIONS**

**SURVIVAL**

| conc. (mg/L Cl) | Control |    |    |   | 75 |    |    |   | 150 |    |    |   | 300 |    |    |   | 600 |    |    |   | 1200 |    |    |   |
|-----------------|---------|----|----|---|----|----|----|---|-----|----|----|---|-----|----|----|---|-----|----|----|---|------|----|----|---|
|                 | A       | B  | C  | D | A  | B  | C  | D | A   | B  | C  | D | A   | B  | C  | D | A   | B  | C  | D | A    | B  | C  | D |
| 1               | 10      |    |    | ↑ | 10 |    |    | ↑ | 10  |    |    | ↑ | 10  |    |    | ↑ | 10  |    |    | ↑ | 10   |    |    | ↑ |
| 2               | 10      |    |    | ↑ | 10 |    |    | ↑ | 10  |    |    | ↑ | 10  |    |    | ↑ | 10  |    |    | ↑ | 10   |    |    | ↑ |
| 3               | 10      |    |    | ↑ | 10 |    |    | ↑ | 10  |    |    | ↑ | 10  |    |    | ↑ | 10  |    |    | ↑ | 10   |    |    | ↑ |
| 4               | 10      |    |    | ↑ | 10 |    |    | ↑ | 10  |    |    | ↑ | 10  |    |    | ↑ | 10  |    |    | ↑ | 10   |    |    | ↑ |
| 5               | 10      |    |    | ↑ | 10 |    |    | ↑ | 10  |    |    | ↑ | 10  |    |    | ↑ | 10  |    |    | ↑ | 10   |    |    | ↑ |
| 6               | 10      |    |    | ↑ | 10 |    |    | ↑ | 10  |    |    | ↑ | 10  |    |    | ↑ | 10  |    |    | ↑ | 10   |    |    | ↑ |
| 7               | 10      |    |    | ↑ | 10 |    |    | ↑ | 10  |    |    | ↑ | 10  |    |    | ↑ | 10  |    |    | ↑ | 10   |    |    | ↑ |
| 8               | 10      | 10 | 10 | ↑ | 10 | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10   | 10 | 10 | ↑ |
| 9               | 10      | 10 | 10 | ↑ | 10 | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10   | 10 | 10 | ↑ |
| 10              | 10      | 10 | 10 | ↑ | 10 | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10   | 10 | 10 | ↑ |
| 11              | 10      | 10 | 10 | ↑ | 10 | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10   | 10 | 10 | ↑ |
| 12              | 10      | 10 | 10 | ↑ | 10 | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10   | 10 | 10 | ↑ |
| 13              | 10      | 10 | 10 | ↑ | 10 | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10   | 10 | 10 | ↑ |
| 14              | 10      | 10 | 10 | ↑ | 10 | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10   | 10 | 10 | ↑ |
| 15              | 10      | 10 | 10 | ↑ | 10 | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10   | 10 | 10 | ↑ |
| 16              | 10      | 10 | 10 | ↑ | 10 | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10   | 10 | 10 | ↑ |
| 17              | 10      | 10 | 10 | ↑ | 10 | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10   | 10 | 10 | ↑ |
| 18              | 10      | 10 | 10 | ↑ | 10 | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10   | 10 | 10 | ↑ |
| 19              | 10      | 10 | 10 | ↑ | 10 | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10   | 10 | 10 | ↑ |
| 20              | 10      | 10 | 10 | ↑ | 10 | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10   | 10 | 10 | ↑ |
| 21              | 10      | 10 | 10 | ↑ | 10 | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10   | 10 | 10 | ↑ |
| 22              | 10      | 10 | 10 | ↑ | 10 | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10   | 10 | 10 | ↑ |
| 23              | 10      | 10 | 10 | ↑ | 10 | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10   | 10 | 10 | ↑ |
| 24              | 10      | 10 | 10 | ↑ | 10 | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10   | 10 | 10 | ↑ |
| 25              | 10      | 10 | 10 | ↑ | 10 | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10   | 10 | 10 | ↑ |
| 26              | 10      | 10 | 10 | ↑ | 10 | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10   | 10 | 10 | ↑ |
| 27              | 10      | 10 | 10 | ↑ | 10 | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10   | 10 | 10 | ↑ |
| 28              | 10      | 10 | 10 | ↑ | 10 | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10  | 10 | 10 | ↑ | 10   | 10 | 10 | ↑ |

600 C  
→ W. development  
Day 14, 75  
Cate  
A B C D  
10 7 6 8

Reviewed By:

WJST

Date Reviewed:

2018-02-28

\* CTD Day 15 - killed by tech  
# 160 B - killed by tech (day 17)  
See - killed by tech (day 17)

Superscript = A removed

Day 24 - 1 emerged, 1 dead.  
from transferred, 1 ML, 2000



### DAILY TEST OBSERVATIONS

[illegible]

Day 28 75B  
- on deck - PE

N=Nymph      PE = Pre-Emergent      SI = Sub-Imago

$$I = \text{Im} \alpha_0$$

Day 28 - 300B - 1 dead before inner stage  
700C - 1 dead while emerging  
700S - 1 dead

Reviewed By:

artist

Reviewed By: must

Day 27-75c  
-1-dredhukile 75a  
Written by: JP 2018/08/03 emw, me

~~SA-ZASOCLZ-1000~~

Nautilus Environmental (Calgary)  
248.16.123 ~ 750.44.44

360A - 1 fly did not emerge

pay 24-1500,  
net still  
give 200000

Uncontrolled Document

SP1718-015



**DAILY TEST OBSERVATIONS**

DO (%) 80 - 100% saturation

| conc. (mg/L Cl <sup>-</sup> ) | Control |     |     |     | 75  |     |     |     | 150 |     |     |     | 300 |     |     |     | 600 |     |     |     | 1200 |     |     |     |     |
|-------------------------------|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|
|                               | A       | B   | C   | D   | A   | B   | C   | D   | A   | B   | C   | D   | A   | B   | C   | D   | A   | B   | C   | D   | A    | B   | C   | D   |     |
| 1                             | 7.9     | 8.0 | 8.1 | 8.2 | 8.1 | 8.1 | 8.2 | 8.1 | 8.4 | 8.4 | 8.4 | 8.7 | 8.7 | 8.5 | 8.5 | 8.7 | 8.7 | 8.8 | 8.7 | 8.7 | 8.7  | 8.8 | 8.7 | 8.7 | 8.7 |
| 2                             | 8.7     | 8.7 | 8.8 | 8.8 | 8.6 | 8.7 | 8.7 | 8.7 | 8.6 | 8.7 | 8.7 | 8.7 | 8.7 | 8.7 | 8.7 | 8.7 | 8.7 | 8.7 | 8.7 | 8.7 | 8.7  | 8.7 | 8.7 | 8.7 | 8.7 |
| 3                             | 9.0     | 9.0 | 9.0 | 9.0 | 8.9 | 9.0 | 9.0 | 9.0 | 8.8 | 8.8 | 8.8 | 8.8 | 8.9 | 8.9 | 9.1 | 9.1 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0  | 9.0 | 9.0 | 9.0 | 9.0 |
| 4                             | 8.2     | 8.5 | 8.6 | 8.6 | 8.4 | 8.4 | 8.6 | 8.6 | 8.5 | 8.5 | 8.4 | 8.0 | 8.0 | 8.5 | 8.4 | 8.4 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3  | 8.3 | 8.3 | 8.3 | 8.3 |
| 5                             | 8.0     | 8.0 | 8.0 | 8.0 | 8.2 | 8.2 | 8.2 | 8.0 | 8.1 | 8.1 | 8.1 | 8.0 | 8.0 | 8.0 | 8.0 | 8.1 | 8.1 | 8.1 | 8.1 | 8.1 | 8.1  | 8.1 | 8.1 | 8.1 | 8.1 |
| 6                             | 8.2     | 8.2 | 8.2 | 8.2 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0  | 8.0 | 8.0 | 8.0 | 8.0 |
| 7                             | 8.3     | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3  | 8.3 | 8.3 | 8.3 | 8.3 |
| 8 * 75                        | 7.5     | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5  | 7.5 | 7.5 | 7.5 | 7.5 |
| 9                             | 7.4     | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4  | 7.4 | 7.4 | 7.4 | 7.4 |
| 10                            | 7.4     | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4  | 7.4 | 7.4 | 7.4 | 7.4 |
| 11                            | 7.4     | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4  | 7.4 | 7.4 | 7.4 | 7.4 |
| 12                            | 7.4     | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4  | 7.4 | 7.4 | 7.4 | 7.4 |
| 13                            | 7.4     | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4  | 7.4 | 7.4 | 7.4 | 7.4 |
| 14                            | 7.4     | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4  | 7.4 | 7.4 | 7.4 | 7.4 |
| 15                            | 7.4     | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4  | 7.4 | 7.4 | 7.4 | 7.4 |
| 16                            | 7.4     | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4  | 7.4 | 7.4 | 7.4 | 7.4 |
| 17                            | 7.3     | 7.3 | 7.3 | 7.3 | 7.3 | 7.3 | 7.3 | 7.3 | 7.3 | 7.3 | 7.3 | 7.3 | 7.3 | 7.3 | 7.3 | 7.3 | 7.3 | 7.3 | 7.3 | 7.3 | 7.3  | 7.3 | 7.3 | 7.3 | 7.3 |
| 18                            | 7.2     | 7.2 | 7.2 | 7.2 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1  | 7.1 | 7.1 | 7.1 | 7.1 |
| 19                            | 7.5     | 7.5 | 7.5 | 7.5 | 7.6 | 7.6 | 7.6 | 7.6 | 7.5 | 7.5 | 7.5 | 7.5 | 7.6 | 7.6 | 7.6 | 7.6 | 7.6 | 7.6 | 7.6 | 7.6 | 7.6  | 7.6 | 7.6 | 7.6 | 7.6 |
| 20                            | 7.2     | 7.2 | 7.2 | 7.2 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1  | 7.1 | 7.1 | 7.1 | 7.1 |
| 21                            | 7.4     | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4  | 7.4 | 7.4 | 7.4 | 7.4 |
| 22                            | 7.2     | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2  | 7.2 | 7.2 | 7.2 | 7.2 |
| 23                            | 7.4     | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4  | 7.4 | 7.4 | 7.4 | 7.4 |
| 24                            | 7.4     | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4  | 7.4 | 7.4 | 7.4 | 7.4 |
| 25                            | 7.4     | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4  | 7.4 | 7.4 | 7.4 | 7.4 |
| 26                            | 7.4     | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4  | 7.4 | 7.4 | 7.4 | 7.4 |
| 27                            | 7.4     | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4  | 7.4 | 7.4 | 7.4 | 7.4 |
| 28                            | 7.4     | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4  | 7.4 | 7.4 | 7.4 | 7.4 |

Reviewed By:

7/3/24

7/3/24

Date Reviewed:

7/3/24



Water Type

SW

Client:

Equilibrium

Sample Reference:

SP1718-015

## DAILY TEST OBSERVATIONS

Temperature (°C) - 24 +/- 1

| conc. (mg/L Cl) | Control |    |    |    | 75 |    |    |    | 150 |    |    |    | 300 |    |    |    | 600 |    |    |    | 1200 |    |    |    |
|-----------------|---------|----|----|----|----|----|----|----|-----|----|----|----|-----|----|----|----|-----|----|----|----|------|----|----|----|
|                 | A       | B  | C  | D  | A  | B  | C  | D  | A   | B  | C  | D  | A   | B  | C  | D  | A   | B  | C  | D  | A    | B  | C  | D  |
| 1               | 23      | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23   | 23 | 23 | 23 |
| 2               | 23      | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23   | 23 | 23 | 23 |
| 3               | 23      | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23   | 23 | 23 | 23 |
| 4               | 23      | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23   | 23 | 23 | 23 |
| 5               | 23      | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23   | 23 | 23 | 23 |
| 6               | 23      | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23   | 23 | 23 | 23 |
| 7               | 23      | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23   | 23 | 23 | 23 |
| 8               | 23      | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23   | 23 | 23 | 23 |
| 9               | 23      | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23   | 23 | 23 | 23 |
| 10              | 23      | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23   | 23 | 23 | 23 |
| 11              | 23      | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23   | 23 | 23 | 23 |
| 12              | 23      | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23   | 23 | 23 | 23 |
| 13              | 23      | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23   | 23 | 23 | 23 |
| 14              | 23      | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23   | 23 | 23 | 23 |
| 15              | 23      | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23   | 23 | 23 | 23 |
| 16              | 23      | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23   | 23 | 23 | 23 |
| 17              | 23      | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23   | 23 | 23 | 23 |
| 18              | 23      | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23   | 23 | 23 | 23 |
| 19              | 23      | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23   | 23 | 23 | 23 |
| 20              | 23      | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23   | 23 | 23 | 23 |
| 21              | 24      | 23 | 23 | 23 | 24 | 23 | 23 | 23 | 24  | 23 | 23 | 23 | 24  | 23 | 23 | 23 | 24  | 23 | 23 | 23 | 24   | 23 | 23 | 23 |
| 22              | 23      | 23 | 23 | 23 | 24 | 23 | 23 | 23 | 24  | 23 | 23 | 23 | 24  | 23 | 23 | 23 | 24  | 23 | 23 | 23 | 24   | 23 | 23 | 23 |
| 23              | 24      | 23 | 23 | 23 | 24 | 23 | 23 | 23 | 24  | 23 | 23 | 23 | 24  | 23 | 23 | 23 | 24  | 23 | 23 | 23 | 24   | 23 | 23 | 23 |
| 24              | 24      | 23 | 23 | 23 | 24 | 23 | 23 | 23 | 24  | 23 | 23 | 23 | 24  | 23 | 23 | 23 | 24  | 23 | 23 | 23 | 24   | 23 | 23 | 23 |
| 25              | 24      | 23 | 23 | 23 | 24 | 23 | 23 | 23 | 24  | 23 | 23 | 23 | 24  | 23 | 23 | 23 | 24  | 23 | 23 | 23 | 24   | 23 | 23 | 23 |
| 26              | 24      | 23 | 23 | 23 | 24 | 23 | 23 | 23 | 24  | 23 | 23 | 23 | 24  | 23 | 23 | 23 | 24  | 23 | 23 | 23 | 24   | 23 | 23 | 23 |
| 27              | 24      | 23 | 23 | 23 | 24 | 23 | 23 | 23 | 24  | 23 | 23 | 23 | 24  | 23 | 23 | 23 | 24  | 23 | 23 | 23 | 24   | 23 | 23 | 23 |
| 28              | 24      | 23 | 23 | 23 | 24 | 23 | 23 | 23 | 24  | 23 | 23 | 23 | 24  | 23 | 23 | 23 | 24  | 23 | 23 | 23 | 24   | 23 | 23 | 23 |

Reviewed By:

Date Reviewed:

2018/10/22

2018/11/02

WJST

From day 25-day 28

NO DO for 1st b/c

empty





## comment summary

Date: \_\_\_\_\_  
Initials: \_\_\_\_\_

Day 14 - CFA dropped to Do 2.9  $\Rightarrow$  high mortality  
 $\hookrightarrow$  exclude from stats

Concentration:

SU-CTL

Day:

22

Initials:

MLIST

Date:

—

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 4                   | 2              | 2                          | 0                           | 0                     | 2                       | 4              |
| B     | 7                   | 1              | 2                          | 0                           | 0                     | 6                       | 7              |
| C     | 6                   | 0              | 0                          | 0                           | 0                     | 6                       | 6              |
| D     | 8                   | 1              | 1                          | 0                           | 0                     | 7                       | 8              |

Day:

23

Initials:

MLIST

Date:

—

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 2                   | 2              | 2                          | 2                           | 2                     | 0                       | 4              |
| B     | 6                   | 3              | 3                          | 1                           | 1                     | 3                       | 7              |
| C     | 6                   | 3              | 3                          | 0                           | 0                     | 6                       | 6              |
| D     | 7                   | 1              | 1                          | 1                           | 1                     | 6                       | 8              |

Day:

24

Initials:

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Date:

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| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | —                   | —              | —                          | 2                           | 4                     | —                       | 4              |
| B     | 3                   | 1              | 1                          | 3                           | 4                     | 2                       | 7              |
| C     | 1                   | 6              | 6                          | 3                           | 5                     | 0                       | 6              |
| D     | 6                   | 0              | 0                          | 1                           | 2                     | 6                       | 8              |

Day:

25

Initials:

—

Date:

—

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | —                   | —              | —                          | —                           | 4                     | —                       | 4              |
| B     | 2                   | 0              | 0                          | 1                           | 3                     | 2                       | 7              |
| C     | —                   | —              | —                          | 1                           | 6                     | —                       | 6              |
| D     | 6                   | 1              | 1                          | 0                           | 2                     | 5                       | 8              |

Day:

26

Initials:

—

Date:

—

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | —                   | —              | —                          | —                           | 4                     | —                       | 4              |
| B     | 2                   | 1              | 1                          | 0                           | 3                     | 1                       | 7              |
| C     | —                   | —              | —                          | —                           | 6                     | —                       | 6              |
| D     | 5                   | 2              | 2                          | 1                           | 3                     | 3                       | 8              |



Concentration: SW-CD

 Day: 27 Initials: ✓ Date: —

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 1                   | 1              | 1                          | 1                           | 4                     | 4                       | 4              |
| B     | 1                   | 1              | 1                          | 1                           | 6                     | 0                       | 4              |
| C     | 1                   | 1              | 1                          | 1                           | 6                     | 1                       | 6              |
| D     | 3                   | 2              | 2                          | 1                           | 4                     | 1                       | 4              |

 Day: 28 Initials: ✓ Date: —

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 1                   | 1              | 1                          | 1                           | 4                     | 4                       | 4              |
| B     | 1                   | 1              | 1                          | 1                           | 6                     | 1                       | 4              |
| C     | 1                   | 1              | 1                          | 1                           | 6                     | 0                       | 4              |
| D     | 1                   | 1              | 1                          | 2                           | 6                     | 0                       | 4              |

 Day: 29 Initials: — Date: —

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | /                   | /              | /                          | 1                           | 4                     | /                       | 4              |
| B     | /                   | /              | /                          | 1                           | 6                     | /                       | 4              |
| C     | /                   | /              | /                          | 1                           | 6                     | /                       | 4              |
| D     | /                   | /              | /                          | 1                           | 4                     | /                       | 4              |

 Day: — Initials: — Date: —

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     |                     |                |                            |                             |                       |                         |                |

 Day: — Initials: — Date: —

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     |                     |                |                            |                             |                       |                         |                |

Concentration: SW-75

 Day: 22 Initials: \_\_\_\_\_ Date: \_\_\_\_\_

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 6                   | 3              | 3                          | 0                           | 0                     | 3                       | 6              |
| B     | 8                   | 3              | 3                          | 0                           | 0                     | 3                       | 9              |
| C     | 9                   | 0              | 9                          | 0                           | 0                     | 9                       | 9              |
| D     | 7                   | 1              | 9                          | 0                           | 0                     | 0                       | 7              |

 Day: 23 Initials: \_\_\_\_\_ Date: \_\_\_\_\_

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 3                   | 1              | 1                          | 3                           | 3                     | 2                       | 6              |
| B     | 6                   | 0              | 0                          | 2                           | 2                     | 6                       | 8              |
| C     | 9                   | 1              | 1                          | 0                           | 0                     | 8                       | 9              |
| D     | 6                   | 1              | 1                          | 0                           | 1                     | 5                       | 7              |

 Day: 24 Initials: \_\_\_\_\_ Date: \_\_\_\_\_

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 2                   | 2              | 2                          | 1                           | 4                     | 0                       | 6              |
| B     | 6                   | 0              | 0                          | 0                           | 2                     | 6                       | 8              |
| C     | 8                   | 0              | 0                          | 1                           | 1                     | 8                       | 9              |
| D     | 5                   | 3              | 3                          | 1                           | 2                     | 2                       | 7              |

 Day: 25 Initials: \_\_\_\_\_ Date: \_\_\_\_\_

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | —                   | —              | —                          | 2                           | 6                     | —                       | 6              |
| B     | 6                   | 3              | 3                          | 0                           | 2                     | 3                       | 8              |
| C     | 8                   | 1              | 1                          | 0                           | 1                     | 7                       | 9              |
| D     | 2                   | 2              | 2                          | 3                           | 5                     | 0                       | 7              |

 Day: 26 Initials: \_\_\_\_\_ Date: \_\_\_\_\_

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | —                   | —              | —                          | —                           | 6                     | —                       | 6              |
| B     | 3                   | 0              | 0                          | 2                           | 4                     | 3                       | 7              |
| C     | 7                   | 3              | 3                          | 1                           | 2                     | 4                       | 9              |
| D     | —                   | —              | —                          | —                           | 6                     | —                       | 6              |



Concentration:

SW-75

Day:

27

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | —                   | —              | —                          | —                           | 6                     | —                       | 6              |
| B     | 3                   | 3              | 3                          | 0                           | 4                     | 0                       | 7              |
| C     | 4                   | 1              | 1                          | 2                           | 4                     | 3                       | 8              |
| D     | —                   | —              | —                          | —                           | 6                     | —                       | 6              |

Day:

28

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | —                   | —              | —                          | —                           | 6                     | —                       | 6              |
| B     | —                   | —              | —                          | 2                           | 6                     | —                       | 6              |
| C     | 3                   | 1              | 1                          | 1                           | 5                     | 2                       | 6              |
| D     | —                   | —              | —                          | —                           | 6                     | —                       | 6              |

Day:

29

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | /                   | /              | /                          | —                           | 6                     | /                       | 6              |
| B     | /                   | /              | /                          | 0                           | 6                     | /                       | 6              |
| C     | /                   | /              | /                          | 1                           | 6                     | /                       | 8 (2 nymphs)   |
| D     | /                   | /              | /                          | —                           | 6                     | /                       | 6              |

Day:

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     |                     |                |                            |                             |                       |                         |                |

Day:

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     |                     |                |                            |                             |                       |                         |                |

Concentration:

SW-150

Day:

22

Initials:

—

Date:

—

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 16                  | 4              | 4                          | 0                           | 0                     | 6                       | 10             |
| B     | 5                   | 1              | 1                          | 0                           | 0                     | 5                       | 5              |
| C     | 5                   | 2              | 2                          | 0                           | 0                     | 3                       | 5              |
| D     | 8                   | 1              | 1                          | 0                           | 0                     | 7                       | 8              |

Day:

23

Initials:

—

Date:

—

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 6                   | 0              | 0                          | 4                           | 4                     | 6                       | 10             |
| B     | 4                   | 0              | 1                          | 1                           | 1                     | 5                       | 5              |
| C     | 3                   | 0              | 0                          | 2                           | 2                     | 3                       | 5              |
| D     | 7                   | 2              | 2                          | 1                           | 1                     | 5                       | 8              |

Day:

24

Initials:

—

Date:

—

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 6                   | 0              | 0                          | 0                           | 4                     | 6                       | 10             |
| B     | 3                   | 2              | 2                          | 0                           | 2                     | 4                       | 5              |
| C     | 3                   | 2              | 2                          | 0                           | 2                     | 1                       | 5              |
| D     | 5                   | 2              | 2                          | 1                           | 2                     | 3                       | 7              |

Day:

25

Initials:

—

Date:

—

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 6                   | 4              | 4                          | 0                           | 4                     | 2                       | 10             |
| B     | 6                   | 0              | 0                          | 2                           | 4                     | 1                       | 5              |
| C     | 1                   | 1              | 1                          | 2                           | 4                     | 0                       | 5              |
| D     | 3                   | 1              | 1                          | 2                           | 4                     | 2                       | 7              |

Day:

26

Initials:

—

Date:

—

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 2                   | 0              | 0                          | 3                           | 3                     | 2                       | 4              |
| B     | 1                   | 0              | 0                          | 0                           | 1                     | 1                       | 2              |
| C     | 1                   | 0              | 0                          | 1                           | 1                     | 1                       | 2              |
| D     | 2                   | 0              | 0                          | 1                           | 3                     | 2                       | 4              |



Concentration:

5W 150

Day:

27

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 2                   | 1              | 1                          | 0                           | 1                     | 6                       | 9              |
| B     | 1                   | 1              | 1                          | 0                           | 1                     | 6                       | 3              |
| C     | 1                   | 1              | 1                          | 0                           | 1                     | 1                       | 3              |
| D     | 2                   | 1              | 1                          | 0                           | 3                     | 1                       | 7              |

Day:

28

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 1                   | 1              | 1                          | 1                           | 8                     | 0                       | 9              |
| B     | 1                   | 1              | 1                          | 1                           | 3                     | 1                       | 3              |
| C     | 1                   | 1              | 1                          | 1                           | 3                     | 1                       | 3              |
| D     | 1                   | 0              | 0                          | 1                           | 6                     | 1                       | 7              |

Day:

29

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | /                   | /              | /                          | 1                           | 9                     | 1                       | 9              |
| B     | /                   | /              | /                          | 1                           | 3                     | 1                       | 3              |
| C     | /                   | /              | /                          | 0                           | 3                     | 1                       | 3              |
| D     | /                   | /              | /                          | 0                           | 6                     | 1                       | 7 (in jar)     |

Day:

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     |                     |                |                            |                             |                       |                         |                |

Day:

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     |                     |                |                            |                             |                       |                         |                |

Concentration:

20-300

Day:

22

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 5                   | 0              | 0                          | 0                           | 0                     | 5                       | 5              |
| B     | 7                   | 2              | 2                          | 0                           | 0                     | 5                       | 7              |
| C     | 8                   | 0              | 0                          | 0                           | 0                     | 8                       | 8              |
| D     | 6                   | 0              | 0                          | 0                           | 0                     | 6                       | 6              |

Day:

23

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 5                   | 2              | 2                          | 0                           | 0                     | 3                       | 5              |
| B     | 5                   | 1              | 1                          | 2                           | 2                     | 4                       | 7              |
| C     | 8                   | 0              | 0                          | 0                           | 0                     | 8                       | 8              |
| D     | 6                   | 1              | 1                          | 0                           | 0                     | 5                       | 6              |

Day:

24

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 3                   | 1              | 1                          | 1*                          | 1                     | 2                       | 5*             |
| B     | 4                   | 1              | 1                          | 1                           | 3                     | 3                       | 7              |
| C     | 8                   | 3              | 3                          | 0                           | 0                     | 7                       | 8              |
| D     | 5                   | 3              | 3                          | 1                           | 1                     | 2                       | 6              |

\* 1 fly didn't emerge but emerged 2 days later, included here

Day:

25

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 2                   | 1              | 1                          | 2                           | 3                     | 1                       | 5              |
| B     | 3                   | 0              | 0                          | 1                           | 4                     | 3                       | 7              |
| C     | 7                   | 0              | 0                          | 1                           | 1                     | 7                       | 8              |
| D     | 2                   | 2              | 2                          | 3                           | 4                     | 0                       | 6              |

Day:

26

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 1                   | 0              | 0                          | 1                           | 4                     | 1                       | 5              |
| B     | 3                   | 0              | 0                          | 0                           | 4                     | 3                       | 7              |
| C     | 7                   | 3              | 3                          | 0                           | 1                     | 4                       | 8              |
| D     | 1                   | 1              | 2                          | 2                           | 6                     | 1                       | 6              |



Concentration:

50-300

Day:

27

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 1                   | 0              | 0                          | 0                           | 4                     | 1                       | 5              |
| B     | 3                   | 0              | 0                          | 0                           | 4                     | 0                       | 7              |
| C     | 4                   | 2              | 2                          | 3                           | 4                     | 2                       | 8              |
| D     | 1                   | 1              | 1                          | 1                           | 6                     | 1                       | 6              |

Day:

28

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 1                   | 0              | 0                          | 0-4                         | 4                     | 1                       | 5              |
| B     | 1                   | 0              | 0                          | 2-4                         | 6                     | 1                       | 6              |
| C     | 2                   | 0              | 0                          | 1                           | 3                     | 2                       | 7              |
| D     | 1                   | 0              | 0                          | 1                           | 6                     | 1                       | 6              |

Day:

29

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | /                   | /              | /                          | 0                           | 4                     | /                       | 5 (nymph)      |
| B     | /                   | /              | /                          | 0                           | 6                     | /                       | 6              |
| C     | /                   | /              | /                          | 0                           | 3                     | /                       | 7 (2 nymphs)   |
| D     | /                   | /              | /                          | 0                           | 6                     | /                       | 6              |

Day:

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     |                     |                |                            |                             |                       |                         |                |

Day:

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     |                     |                |                            |                             |                       |                         |                |

Concentration:

5N-600

Day:

22

Initials:

-

Date:

-

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | /                   | /              | /                          | /                           | /                     | /                       | 0              |
| B     | /                   | /              | /                          | /                           | /                     | /                       | 0              |
| C     | 1                   | 0              | 0                          | 0                           | 0                     | 1                       | 1              |
| D     | 1                   | 1              | 1                          | 1                           | 1                     | 1                       | 0              |

Day:

23

Initials:

-

Date:

-

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | /                   | /              | /                          | /                           | /                     | /                       | 0              |
| B     | /                   | /              | /                          | /                           | /                     | /                       | 0              |
| C     | 1                   | 0              | 0                          | 0                           | 0                     | 1                       | 0              |
| D     | 1                   | 1              | 1                          | 1                           | 1                     | 1                       | 0              |

Day:

24

Initials:

-

Date:

-

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | /                   | /              | /                          | /                           | /                     | /                       | 0              |
| B     | /                   | /              | /                          | /                           | /                     | /                       | 0              |
| C     | 1                   | 0              | 0                          | 0                           | 0                     | 1                       | 0              |
| D     | 1                   | 1              | 1                          | 1                           | 1                     | 1                       | 0              |

Day:

25

Initials:

-

Date:

-

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | /                   | /              | /                          | /                           | /                     | /                       | 0              |
| B     | /                   | /              | /                          | /                           | /                     | /                       | 0              |
| C     | 1                   | 0              | 0                          | 0                           | 0                     | 1                       | 0              |
| D     | 1                   | 1              | 1                          | 1                           | 1                     | 1                       | 0              |

Day:

26

Initials:

-

Date:

-

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | /                   | /              | /                          | /                           | /                     | /                       | 0              |
| B     | /                   | /              | /                          | /                           | /                     | /                       | 0              |
| C     | 1                   | 0              | 0                          | 0                           | 0                     | 1                       | 0              |
| D     | 1                   | 1              | 1                          | 1                           | 1                     | 1                       | 0              |



Concentration:

SW-600

Day:

27

Initials:

-

Date:

-

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | /                   | /              | /                          | /                           | /                     | /                       | 8              |
| B     | /                   | /              | /                          | /                           | /                     | /                       | 8              |
| C     | 1                   | 0              | 0                          | 0                           | 0                     | 1                       | 5              |
| D     | -                   | -              | -                          | -                           | -                     | -                       | 0              |

Day:

28

Initials:

-

Date:

-

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | /                   | /              | /                          | /                           | /                     | /                       | 8              |
| B     | /                   | /              | /                          | /                           | /                     | /                       | 8              |
| C     | 1                   | 0              | 0                          | 0                           | 0                     | 1                       | 5              |
| D     | -                   | -              | -                          | -                           | -                     | -                       | 0              |

Day:

29

Initials:

-

Date:

-

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | /                   | /              | /                          | /                           | /                     | /                       | 8              |
| B     | /                   | /              | /                          | /                           | /                     | /                       | 8              |
| C     | /                   | /              | /                          | /                           | /                     | /                       | 8              |
| D     | /                   | /              | /                          | /                           | /                     | /                       | 8              |

Day:

-

Initials:

-

Date:

-

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     |                     |                |                            |                             |                       |                         |                |

Day:

-

Initials:

-

Date:

-

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     |                     |                |                            |                             |                       |                         |                |

Client NAULUS Sample SP 1718-015 Organism MA Batch SW

| Item Weighed          | Date     | Initials | Balance* |
|-----------------------|----------|----------|----------|
| dried pan             | 20180717 | ST       | Butcher  |
| dried pan + organisms | 20180713 | WU       | WU       |

\* same balance must be used for initial and final weights  
 \* for FM/HA/CT, must use scale with 0.01 mg accuracy

## Concentration

| Replicate | SW CTN N          | Initial | Final |
|-----------|-------------------|---------|-------|
| a         | <del>990.77</del> |         |       |
| b         | <del>989.43</del> |         |       |
| c         | <del>995.28</del> |         |       |
| d         | <del>989.09</del> |         |       |
| e         |                   |         |       |

| SW CTN E | Initial | Final |
|----------|---------|-------|
| 994.76   | 994.93  |       |
| 984.07   | 994.11  |       |
| 1003.67  | 993.18  |       |
| 986.89   | 991.28  |       |
| 991.66   |         |       |

| SW 75 N           | Initial | Final |
|-------------------|---------|-------|
| <del>996.93</del> |         |       |
| <del>994.11</del> |         |       |
| <del>993.18</del> |         |       |
| <del>991.28</del> |         |       |

| SW 75 E | Initial | Final |
|---------|---------|-------|
| 996.56  | 999.15  |       |
| 984.17  | 998.03  |       |
| 990.22  | 992.74  |       |
| 990.68  | 993.27  |       |

| SW 150 N           | Initial | Final |
|--------------------|---------|-------|
| <del>994.11</del>  |         |       |
| <del>1001.50</del> |         |       |
| <del>991.18</del>  |         |       |
| <del>989.58</del>  |         |       |

| SW 150 E | Initial | Final |
|----------|---------|-------|
| 998.02   | 998.51  |       |
| 990.82   | 993.81  |       |
| 996.64   | 999.16  |       |
| 996.21   | 998.61  |       |

## Concentration

| Replicate | SW 300 N          | Initial | Final |
|-----------|-------------------|---------|-------|
| a         | <del>991.11</del> |         |       |
| b         | <del>989.44</del> |         |       |
| c         | <del>990.82</del> |         |       |
| d         | <del>995.15</del> |         |       |
| e         |                   |         |       |

| SW 300 E | Initial | Final |
|----------|---------|-------|
| 990.88   | 992.49  |       |
| 998.57   | 1001.01 |       |
| 1001.22  | 1003.01 |       |
| 996.00   | 998.92  |       |

| SW 600 N          | Initial | Final |
|-------------------|---------|-------|
| <del>989.82</del> |         |       |

| SW 600 E          | Initial | Final |
|-------------------|---------|-------|
| <del>989.90</del> |         |       |
| <del>990.03</del> |         |       |
| <del>990.08</del> |         |       |

| Initial | Final |
|---------|-------|
|         |       |
|         |       |
|         |       |

| Initial | Final |
|---------|-------|
|         |       |
|         |       |
|         |       |

## Balance Calibration Check:

first pan weighed: SW Initial 990.77  
 weight of first pan: 990.77  
 other pans weighed: 990.77

| Final         |
|---------------|
| <u>990.09</u> |
| <u>990.03</u> |

% difference <5%: Yes/No

$$\% \text{ difference} = \frac{(\text{initial weight} - \text{reweight})}{(\text{initial weight} + \text{reweight}) / 2} \times 100\%$$

Test Validity Met: Yes/No/NA

Results are Logical\*\*: Yes/No

\*\* no negative numbers, consistent values across replicates

If "no" is circled for any parameter, notify Lab Supervisor/  
 QA Group to determine appropriate action

Reviewed By: \_\_\_\_\_ Date Reviewed: \_\_\_\_\_

## CETIS Analytical Report

Report Date: 04 Dec-18 09:17 (p 1 of 2)  
 Test Code/ID: SP1718-015 SW / 20-9482-9621

| Ephemeroptera (Mayfly) 28-d Test |                |            |                         | Nautilus Environmental Calgary |               |
|----------------------------------|----------------|------------|-------------------------|--------------------------------|---------------|
| Analysis ID:                     | 05-5940-2874   | Endpoint:  | 28d Survival Rate       | CETIS Version:                 | CETISv1.9.4   |
| Analyzed:                        | 04 Dec-18 9:16 | Analysis:  | Trimmed Spearman-Kärber | Status Level:                  | 1             |
| Batch ID:                        | 21-3706-2262   | Test Type: | Growth-Survival (7d)    | Analyst:                       | Madison Lehti |
| Start Date:                      | 28 Aug-18      | Protocol:  | Not Applicable          | Diluent:                       |               |
| Ending Date:                     | 25 Sep-18      | Species:   | Ephemeroptera           | Brine:                         |               |
| Test Length:                     | 28d 0h         | Taxon:     |                         | Source:                        | Age:          |
| Sample ID:                       | 01-8815-6617   | Code:      | SP1718-015 SW           | Project:                       |               |
| Sample Date:                     | 17 Aug-18      | Material:  | chloride                | Source:                        | Equilibrium   |
| Receipt Date:                    | 17 Aug-18      | CAS (PC):  |                         | Station:                       | na            |
| Sample Age:                      | 11d 0h         | Client:    |                         |                                |               |

| Trimmed Spearman-Kärber Estimates |           |       |      |         |       |         |         |
|-----------------------------------|-----------|-------|------|---------|-------|---------|---------|
| Threshold Option                  | Threshold | Trim  | Mu   | Sigma   | LC50  | 95% LCL | 95% UCL |
| Control Threshold                 | 0.3103    | 3.27% | 2.63 | 0.01924 | 426.7 | 390.5   | 466.3   |

| Residual Analysis |                           |           |          |         |                                   |  |
|-------------------|---------------------------|-----------|----------|---------|-----------------------------------|--|
| Attribute         | Method                    | Test Stat | Critical | P-Value | Decision(α:5%)                    |  |
| Extreme Value     | Grubbs Extreme Value Test | 2.763     | 2.78     | 0.0542  | No Outliers Detected              |  |
| Control Trend     | Mann-Kendall Trend Test   | 2.763     |          | 1.0000  | Non-Significant Trend in Controls |  |

| 7d Survival Rate Summary |      |       | Calculated Variate(A/B) |        |        |         |         |         |       | Isotonic Variate |         |
|--------------------------|------|-------|-------------------------|--------|--------|---------|---------|---------|-------|------------------|---------|
| Conc-mg/L                | Code | Count | Mean                    | Min    | Max    | Std Dev | CV%     | %Effect | A/B   | Mean             | %Effect |
| 1.22                     | N    | 3     | 0.6926                  | 0.6000 | 0.7778 | 0.0891  | 12.87%  | 0.0%    | 20/29 | 0.6926           | 0.0%    |
| 78                       |      | 4     | 0.6500                  | 0.6000 | 0.8000 | 0.1000  | 15.38%  | 6.15%   | 26/40 | 0.6639           | 4.14%   |
| 154                      |      | 4     | 0.6778                  | 0.5556 | 0.9000 | 0.1630  | 24.06%  | 2.14%   | 26/38 | 0.6639           | 4.14%   |
| 326.33                   |      | 4     | 0.6000                  | 0.5000 | 0.7000 | 0.0817  | 13.61%  | 13.37%  | 24/40 | 0.6              | 13.37%  |
| 646                      |      | 4     | 0.0250                  | 0.0000 | 0.1000 | 0.0500  | 200.00% | 96.39%  | 1/40  | 0.025            | 96.39%  |
| 1280                     |      | 4     | 0.0000                  | 0.0000 | 0.0000 | 0.0000  |         | 100.0%  | 0/40  | 0                | 100.0%  |

| 7d Survival Rate Detail |      |        |        |        |        |
|-------------------------|------|--------|--------|--------|--------|
| Conc-mg/L               | Code | Rep 1  | Rep 2  | Rep 3  | Rep 4  |
| 1.22                    | N    | 0.7000 | 0.6000 | 0.7778 |        |
| 78                      |      | 0.6000 | 0.6000 | 0.8000 | 0.6000 |
| 154                     |      | 0.9000 | 0.5556 | 0.5556 | 0.7000 |
| 326.33                  |      | 0.5000 | 0.6000 | 0.7000 | 0.6000 |
| 646                     |      | 0.0000 | 0.0000 | 0.1000 | 0.0000 |
| 1280                    |      | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

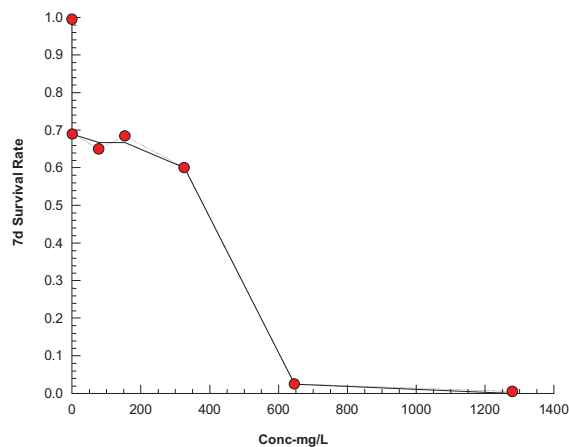
| 7d Survival Rate Binomials |      |       |       |       |       |
|----------------------------|------|-------|-------|-------|-------|
| Conc-mg/L                  | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 |
| 1.22                       | N    | 7/10  | 6/10  | 7/9   |       |
| 78                         |      | 6/10  | 6/10  | 8/10  | 6/10  |
| 154                        |      | 9/10  | 5/9   | 5/9   | 7/10  |
| 326.33                     |      | 5/10  | 6/10  | 7/10  | 6/10  |
| 646                        |      | 0/10  | 0/10  | 1/10  | 0/10  |
| 1280                       |      | 0/10  | 0/10  | 0/10  | 0/10  |

CETIS Analytical Report

Report Date: 04 Dec-18 09:17 (p 2 of 2)  
Test Code/ID: SP1718-015 SW / 20-9482-9621

| Ephemeroptera (Mayfly) 28-d Test |                |           | Nautilus Environmental Calgary |                            |
|----------------------------------|----------------|-----------|--------------------------------|----------------------------|
| Analysis ID:                     | 05-5940-2874   | Endpoint: | 28d Survival Rate              | CETIS Version: CETISv1.9.4 |
| Analyzed:                        | 04 Dec-18 9:16 | Analysis: | Trimmed Spearman-Kärber        | Status Level: 1            |

Graphics





## CETIS Analytical Report

Report Date: 04 Dec-18 09:17 (p 1 of 2)  
 Test Code/ID: SP1718-015 SW / 20-9482-9621

| Ephemeroptera (Mayfly) 28-d Test |  |                                               |  | Nautilus Environmental Calgary    |  |             |  |
|----------------------------------|--|-----------------------------------------------|--|-----------------------------------|--|-------------|--|
| <b>Analysis ID:</b> 06-6776-9488 |  | <b>Endpoint:</b> 28d Survival Rate            |  | <b>CETIS Version:</b> CETISv1.9.4 |  |             |  |
| <b>Analyzed:</b> 04 Dec-18 9:17  |  | <b>Analysis:</b> Linear Interpolation (ICPIN) |  | <b>Status Level:</b> 1            |  |             |  |
| <b>Batch ID:</b> 21-3706-2262    |  | <b>Test Type:</b> Growth-Survival (7d)        |  | <b>Analyst:</b> Madison Lehti     |  |             |  |
| <b>Start Date:</b> 28 Aug-18     |  | <b>Protocol:</b> Not Applicable               |  | <b>Diluent:</b>                   |  |             |  |
| <b>Ending Date:</b> 25 Sep-18    |  | <b>Species:</b> Ephemeroptera                 |  | <b>Brine:</b>                     |  |             |  |
| <b>Test Length:</b> 28d 0h       |  | <b>Taxon:</b>                                 |  | <b>Source:</b>                    |  | <b>Age:</b> |  |
| <b>Sample ID:</b> 01-8815-6617   |  | <b>Code:</b> SP1718-015 SW                    |  | <b>Project:</b>                   |  |             |  |
| <b>Sample Date:</b> 17 Aug-18    |  | <b>Material:</b> chloride                     |  | <b>Source:</b> Equilibrium        |  |             |  |
| <b>Receipt Date:</b> 17 Aug-18   |  | <b>CAS (PC):</b>                              |  | <b>Station:</b> na                |  |             |  |
| <b>Sample Age:</b> 11d 0h        |  | <b>Client:</b>                                |  |                                   |  |             |  |

## Linear Interpolation Options

| X Transform | Y Transform | Seed   | Resamples | Exp 95% CL | Method                  |
|-------------|-------------|--------|-----------|------------|-------------------------|
| Log(X+1)    | Linear      | 350917 | 200       | Yes        | Two-Point Interpolation |

## Residual Analysis

| Attribute     | Method                    | Test Stat | Critical | P-Value | Decision(α:5%)                    |
|---------------|---------------------------|-----------|----------|---------|-----------------------------------|
| Extreme Value | Grubbs Extreme Value Test | 2.763     | 2.78     | 0.0542  | No Outliers Detected              |
| Control Trend | Mann-Kendall Trend Test   | 2.763     |          | 1.0000  | Non-Significant Trend in Controls |

## Point Estimates

| Level | mg/L  | 95% LCL | 95% UCL |
|-------|-------|---------|---------|
| LC5   | 176   | n/a     | 430.3   |
| LC10  | 258.9 | n/a     | 399.4   |
| LC15  | 331.7 | n/a     | 375.2   |
| LC20  | 345.6 | 12.84   | 388     |
| LC25  | 360.1 | 265.9   | 400.3   |
| LC40  | 407.1 | 350.4   | 444.8   |
| LC50  | 441.9 | 390.5   | 477.4   |

## 7d Survival Rate Summary

|           |      |       | Calculated Variate(A/B) |        |        |         |         |         |       | Isotonic Variate |         |
|-----------|------|-------|-------------------------|--------|--------|---------|---------|---------|-------|------------------|---------|
| Conc-mg/L | Code | Count | Mean                    | Min    | Max    | Std Dev | CV%     | %Effect | A/B   | Mean             | %Effect |
| 1.22      | N    | 3     | 0.6926                  | 0.6000 | 0.7778 | 0.0891  | 12.87%  | 0.0%    | 20/29 | 0.6926           | 0.0%    |
| 78        |      | 4     | 0.6500                  | 0.6000 | 0.8000 | 0.1000  | 15.38%  | 6.15%   | 26/40 | 0.6639           | 4.14%   |
| 154       |      | 4     | 0.6778                  | 0.5556 | 0.9000 | 0.1630  | 24.06%  | 2.14%   | 26/38 | 0.6639           | 4.14%   |
| 326.33    |      | 4     | 0.6000                  | 0.5000 | 0.7000 | 0.0817  | 13.61%  | 13.37%  | 24/40 | 0.6              | 13.37%  |
| 646       |      | 4     | 0.0250                  | 0.0000 | 0.1000 | 0.0500  | 200.00% | 96.39%  | 1/40  | 0.025            | 96.39%  |
| 1280      |      | 4     | 0.0000                  | 0.0000 | 0.0000 | 0.0000  |         | 100.0%  | 0/40  | 0                | 100.0%  |

## 7d Survival Rate Detail

| Conc-mg/L | Code | Rep 1  | Rep 2  | Rep 3  | Rep 4  |
|-----------|------|--------|--------|--------|--------|
| 1.22      | N    | 0.7000 | 0.6000 | 0.7778 |        |
| 78        |      | 0.6000 | 0.6000 | 0.8000 | 0.6000 |
| 154       |      | 0.9000 | 0.5556 | 0.5556 | 0.7000 |
| 326.33    |      | 0.5000 | 0.6000 | 0.7000 | 0.6000 |
| 646       |      | 0.0000 | 0.0000 | 0.1000 | 0.0000 |
| 1280      |      | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

## 7d Survival Rate Binomials

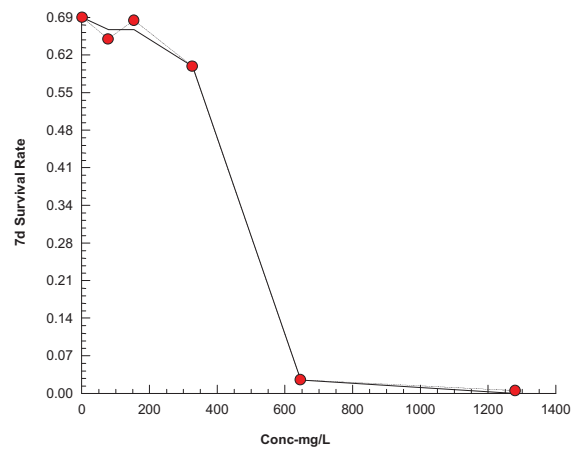
| Conc-mg/L | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 |
|-----------|------|-------|-------|-------|-------|
| 1.22      | N    | 7/10  | 6/10  | 7/9   |       |
| 78        |      | 6/10  | 6/10  | 8/10  | 6/10  |
| 154       |      | 9/10  | 5/9   | 5/9   | 7/10  |
| 326.33    |      | 5/10  | 6/10  | 7/10  | 6/10  |
| 646       |      | 0/10  | 0/10  | 1/10  | 0/10  |
| 1280      |      | 0/10  | 0/10  | 0/10  | 0/10  |

CETIS Analytical Report

Report Date: 04 Dec-18 09:17 (p 2 of 2)  
Test Code/ID: SP1718-015 SW / 20-9482-9621

| Ephemeroptera (Mayfly) 28-d Test |                                        | Nautilus Environmental Calgary |  |
|----------------------------------|----------------------------------------|--------------------------------|--|
| Analysis ID: 06-6776-9488        | Endpoint: 28d Survival Rate            | CETIS Version: CETISv1.9.4     |  |
| Analyzed: 04 Dec-18 9:17         | Analysis: Linear Interpolation (ICPIN) | Status Level: 1                |  |

Graphics



## CETIS Analytical Report

Report Date: 04 Dec-18 09:19 (p 1 of 2)  
 Test Code/ID: SP1718-015 SW / 20-9482-9621

| Ephemeroptera (Mayfly) 28-d Test |                |            |                         | Nautilus Environmental Calgary |               |
|----------------------------------|----------------|------------|-------------------------|--------------------------------|---------------|
| Analysis ID:                     | 04-1789-0946   | Endpoint:  | 28d Emergence Rate      | CETIS Version:                 | CETISv1.9.4   |
| Analyzed:                        | 04 Dec-18 9:18 | Analysis:  | Trimmed Spearman-Kärber | Status Level:                  | 1             |
| Batch ID:                        | 21-3706-2262   | Test Type: | Growth-Survival (7d)    | Analyst:                       | Madison Lehti |
| Start Date:                      | 28 Aug-18      | Protocol:  | Not Applicable          | Diluent:                       |               |
| Ending Date:                     | 25 Sep-18      | Species:   | Ephemeroptera           | Brine:                         |               |
| Test Length:                     | 28d 0h         | Taxon:     |                         | Source:                        | Age:          |
| Sample ID:                       | 01-8815-6617   | Code:      | SP1718-015 SW           | Project:                       |               |
| Sample Date:                     | 17 Aug-18      | Material:  | chloride                | Source:                        | Equilibrium   |
| Receipt Date:                    | 17 Aug-18      | CAS (PC):  |                         | Station:                       | na            |
| Sample Age:                      | 11d 0h         | Client:    |                         |                                |               |

| Trimmed Spearman-Kärber Estimates |           |       |       |         |       |         |         |
|-----------------------------------|-----------|-------|-------|---------|-------|---------|---------|
| Threshold Option                  | Threshold | Trim  | Mu    | Sigma   | LC50  | 95% LCL | 95% UCL |
| Control Threshold                 | 0.3103    | 8.80% | 2.591 | 0.02689 | 389.9 | 344.5   | 441.3   |

| Residual Analysis |                           |           |          |         |                                   |  |
|-------------------|---------------------------|-----------|----------|---------|-----------------------------------|--|
| Attribute         | Method                    | Test Stat | Critical | P-Value | Decision(α:5%)                    |  |
| Extreme Value     | Grubbs Extreme Value Test | 3.415     | 2.78     | 0.0011  | Outlier Detected                  |  |
| Control Trend     | Mann-Kendall Trend Test   | 3.415     |          | 1.0000  | Non-Significant Trend in Controls |  |

| 7d Survival Rate Summary |      |       | Calculated Variate(A/B) |        |        |         |        |         |       | Isotonic Variate |         |
|--------------------------|------|-------|-------------------------|--------|--------|---------|--------|---------|-------|------------------|---------|
| Conc-mg/L                | Code | Count | Mean                    | Min    | Max    | Std Dev | CV%    | %Effect | A/B   | Mean             | %Effect |
| 1.22                     | N    | 3     | 0.6926                  | 0.6000 | 0.7778 | 0.0891  | 12.87% | 0.0%    | 20/29 | 0.6926           | 0.0%    |
| 78                       |      | 4     | 0.6000                  | 0.6000 | 0.6000 | 0.0000  | 0.00%  | 13.37%  | 24/40 | 0.6264           | 9.56%   |
| 154                      |      | 4     | 0.6528                  | 0.5556 | 0.9000 | 0.1661  | 25.45% | 5.75%   | 25/38 | 0.6264           | 9.56%   |
| 326.33                   |      | 4     | 0.5250                  | 0.4000 | 0.6000 | 0.0957  | 18.24% | 24.2%   | 21/40 | 0.525            | 24.2%   |
| 646                      |      | 4     | 0.0000                  | 0.0000 | 0.0000 | 0.0000  |        | 100.0%  | 0/40  | 0                | 100.0%  |
| 1280                     |      | 4     | 0.0000                  | 0.0000 | 0.0000 | 0.0000  |        | 100.0%  | 0/40  | 0                | 100.0%  |

| 7d Survival Rate Detail |      |        |        |        |        |
|-------------------------|------|--------|--------|--------|--------|
| Conc-mg/L               | Code | Rep 1  | Rep 2  | Rep 3  | Rep 4  |
| 1.22                    | N    | 0.7000 | 0.6000 | 0.7778 |        |
| 78                      |      | 0.6000 | 0.6000 | 0.6000 | 0.6000 |
| 154                     |      | 0.9000 | 0.5556 | 0.5556 | 0.6000 |
| 326.33                  |      | 0.4000 | 0.6000 | 0.5000 | 0.6000 |
| 646                     |      | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 1280                    |      | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

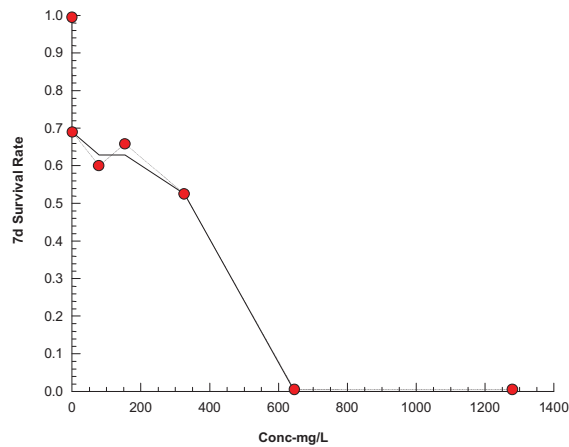
| 7d Survival Rate Binomials |      |       |       |       |       |
|----------------------------|------|-------|-------|-------|-------|
| Conc-mg/L                  | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 |
| 1.22                       | N    | 7/10  | 6/10  | 7/9   |       |
| 78                         |      | 6/10  | 6/10  | 6/10  | 6/10  |
| 154                        |      | 9/10  | 5/9   | 5/9   | 6/10  |
| 326.33                     |      | 4/10  | 6/10  | 5/10  | 6/10  |
| 646                        |      | 0/10  | 0/10  | 0/10  | 0/10  |
| 1280                       |      | 0/10  | 0/10  | 0/10  | 0/10  |

CETIS Analytical Report

Report Date: 04 Dec-18 09:19 (p 2 of 2)  
Test Code/ID: SP1718-015 SW / 20-9482-9621

| Ephemeroptera (Mayfly) 28-d Test |                | Nautilus Environmental Calgary |                         |
|----------------------------------|----------------|--------------------------------|-------------------------|
| Analysis ID:                     | 04-1789-0946   | Endpoint:                      | 28d Emergence Rate      |
| Analized:                        | 04 Dec-18 9:18 | Analysis:                      | Trimmed Spearman-Kärber |
|                                  |                | CETIS Version:                 | CETISv1.9.4             |
|                                  |                | Status Level:                  | 1                       |

Graphics



## CETIS Analytical Report

Report Date: 04 Dec-18 09:19 (p 1 of 2)  
 Test Code/ID: SP1718-015 SW / 20-9482-9621

| Ephemeroptera (Mayfly) 28-d Test |                                        |                            |  | Nautilus Environmental Calgary |  |
|----------------------------------|----------------------------------------|----------------------------|--|--------------------------------|--|
| Analysis ID: 09-0706-4486        | Endpoint: 28d Emergence Rate           | CETIS Version: CETISv1.9.4 |  |                                |  |
| Analyzed: 04 Dec-18 9:19         | Analysis: Linear Interpolation (ICPIN) | Status Level: 1            |  |                                |  |
| Batch ID: 21-3706-2262           | Test Type: Growth-Survival (7d)        | Analyst: Madison Lehti     |  |                                |  |
| Start Date: 28 Aug-18            | Protocol: Not Applicable               | Diluent:                   |  |                                |  |
| Ending Date: 25 Sep-18           | Species: Ephemeroptera                 | Brine:                     |  |                                |  |
| Test Length: 28d 0h              | Taxon:                                 | Source:                    |  | Age:                           |  |
| Sample ID: 01-8815-6617          | Code: SP1718-015 SW                    | Project:                   |  |                                |  |
| Sample Date: 17 Aug-18           | Material: chloride                     | Source: Equilibrium        |  |                                |  |
| Receipt Date: 17 Aug-18          | CAS (PC):                              | Station: na                |  |                                |  |
| Sample Age: 11d 0h               | Client:                                |                            |  |                                |  |

## Linear Interpolation Options

| X Transform | Y Transform | Seed    | Resamples | Exp 95% CL | Method                  |
|-------------|-------------|---------|-----------|------------|-------------------------|
| Log(X+1)    | Linear      | 1120398 | 200       | Yes        | Two-Point Interpolation |

## Residual Analysis

| Attribute     | Method                    | Test Stat | Critical | P-Value | Decision(α:5%)                    |
|---------------|---------------------------|-----------|----------|---------|-----------------------------------|
| Extreme Value | Grubbs Extreme Value Test | 3.415     | 2.78     | 0.0011  | Outlier Detected                  |
| Control Trend | Mann-Kendall Trend Test   | 3.415     |          | 1.0000  | Non-Significant Trend in Controls |

## Point Estimates

| Level | mg/L  | 95% LCL | 95% UCL |
|-------|-------|---------|---------|
| LC5   | 15.88 | n/a     | 350.8   |
| LC10  | 163.5 | n/a     | 427.2   |
| LC15  | 209.8 | n/a     | 419.5   |
| LC20  | 269.1 | n/a     | 404.8   |
| LC25  | 329.6 | 138.2   | 390.2   |
| LC40  | 377.2 | 315     | 432     |
| LC50  | 412.6 | 355.4   | 462.2   |

## 7d Survival Rate Summary

| Conc-mg/L | Code | Count | Calculated Variate(A/B) |        |        |         |        |         |       | Isotonic Variate |         |
|-----------|------|-------|-------------------------|--------|--------|---------|--------|---------|-------|------------------|---------|
|           |      |       | Mean                    | Min    | Max    | Std Dev | CV%    | %Effect | A/B   | Mean             | %Effect |
| 1.22      | N    | 3     | 0.6926                  | 0.6000 | 0.7778 | 0.0891  | 12.87% | 0.0%    | 20/29 | 0.6926           | 0.0%    |
| 78        |      | 4     | 0.6000                  | 0.6000 | 0.6000 | 0.0000  | 0.00%  | 13.37%  | 24/40 | 0.6264           | 9.56%   |
| 154       |      | 4     | 0.6528                  | 0.5556 | 0.9000 | 0.1661  | 25.45% | 5.75%   | 25/38 | 0.6264           | 9.56%   |
| 326.33    |      | 4     | 0.5250                  | 0.4000 | 0.6000 | 0.0957  | 18.24% | 24.2%   | 21/40 | 0.525            | 24.2%   |
| 646       |      | 4     | 0.0000                  | 0.0000 | 0.0000 | 0.0000  |        | 100.0%  | 0/40  | 0                | 100.0%  |
| 1280      |      | 4     | 0.0000                  | 0.0000 | 0.0000 | 0.0000  |        | 100.0%  | 0/40  | 0                | 100.0%  |

## 7d Survival Rate Detail

| Conc-mg/L | Code | Rep 1  | Rep 2  | Rep 3  | Rep 4  |
|-----------|------|--------|--------|--------|--------|
| 1.22      | N    | 0.7000 | 0.6000 | 0.7778 |        |
| 78        |      | 0.6000 | 0.6000 | 0.6000 | 0.6000 |
| 154       |      | 0.9000 | 0.5556 | 0.5556 | 0.6000 |
| 326.33    |      | 0.4000 | 0.6000 | 0.5000 | 0.6000 |
| 646       |      | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 1280      |      | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

## 7d Survival Rate Binomials

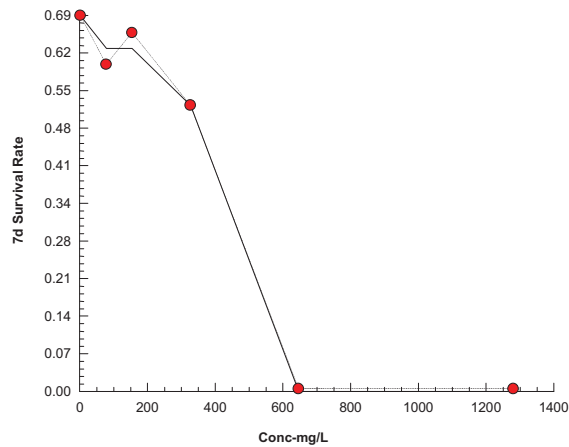
| Conc-mg/L | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 |
|-----------|------|-------|-------|-------|-------|
| 1.22      | N    | 7/10  | 6/10  | 7/9   |       |
| 78        |      | 6/10  | 6/10  | 6/10  | 6/10  |
| 154       |      | 9/10  | 5/9   | 5/9   | 6/10  |
| 326.33    |      | 4/10  | 6/10  | 5/10  | 6/10  |
| 646       |      | 0/10  | 0/10  | 0/10  | 0/10  |
| 1280      |      | 0/10  | 0/10  | 0/10  | 0/10  |

CETIS Analytical Report

Report Date: 04 Dec-18 09:19 (p 2 of 2)  
Test Code/ID: SP1718-015 SW / 20-9482-9621

| Ephemeroptera (Mayfly) 28-d Test |                | Nautilus Environmental Calgary |                              |
|----------------------------------|----------------|--------------------------------|------------------------------|
| Analysis ID:                     | 09-0706-4486   | Endpoint:                      | 28d Emergence Rate           |
| Analyzed:                        | 04 Dec-18 9:19 | Analysis:                      | Linear Interpolation (ICPIN) |
|                                  |                | CETIS Version:                 | CETISv1.9.4                  |
|                                  |                | Status Level:                  | 1                            |

Graphics



## CETIS Analytical Report

Report Date: 04 Dec-18 09:20 (p 1 of 2)  
 Test Code/ID: SP1718-015 SW / 20-9482-9621

| Ephemeroptera (Mayfly) 28-d Test |                |            |                              | Nautilus Environmental Calgary |               |
|----------------------------------|----------------|------------|------------------------------|--------------------------------|---------------|
| Analysis ID:                     | 08-8421-7815   | Endpoint:  | Mean Dry Weight-mg           | CETIS Version:                 | CETISv1.9.4   |
| Analyzed:                        | 04 Dec-18 9:20 | Analysis:  | Linear Interpolation (ICPIN) | Status Level:                  | 1             |
| Batch ID:                        | 21-3706-2262   | Test Type: | Growth-Survival (7d)         | Analyst:                       | Madison Lehti |
| Start Date:                      | 28 Aug-18      | Protocol:  | Not Applicable               | Diluent:                       |               |
| Ending Date:                     | 25 Sep-18      | Species:   | Ephemeroptera                | Brine:                         |               |
| Test Length:                     | 28d 0h         | Taxon:     |                              | Source:                        | Age:          |
| Sample ID:                       | 01-8815-6617   | Code:      | SP1718-015 SW                | Project:                       |               |
| Sample Date:                     | 17 Aug-18      | Material:  | chloride                     | Source:                        | Equilibrium   |
| Receipt Date:                    | 17 Aug-18      | CAS (PC):  |                              | Station:                       | na            |
| Sample Age:                      | 11d 0h         | Client:    |                              |                                |               |

## Linear Interpolation Options

| X Transform | Y Transform | Seed    | Resamples | Exp 95% CL | Method                  |
|-------------|-------------|---------|-----------|------------|-------------------------|
| Log(X+1)    | Linear      | 1274642 | 200       | Yes        | Two-Point Interpolation |

## Residual Analysis

| Attribute     | Method                    | Test Stat | Critical | P-Value | Decision(α:5%)                    |
|---------------|---------------------------|-----------|----------|---------|-----------------------------------|
| Extreme Value | Grubbs Extreme Value Test | 1.801     | 2.548    | 0.8810  | No Outliers Detected              |
| Control Trend | Mann-Kendall Trend Test   | 1.801     |          | 1.0000  | Non-Significant Trend in Controls |

## Point Estimates

| Level | mg/L   | 95% LCL | 95% UCL |
|-------|--------|---------|---------|
| IC5   | 6.304  | 1.65    | n/a     |
| IC10  | 23.03  | n/a     | n/a     |
| IC15  | >326.3 | n/a     | n/a     |
| IC20  | >326.3 | n/a     | n/a     |
| IC25  | >326.3 | n/a     | n/a     |
| IC40  | >326.3 | n/a     | n/a     |
| IC50  | >326.3 | n/a     | n/a     |

## Mean Dry Weight-mg Summary

|           |      |       | Calculated Variate |        |        |         |        |         | Isotonic Variate |         |
|-----------|------|-------|--------------------|--------|--------|---------|--------|---------|------------------|---------|
| Conc-mg/L | Code | Count | Mean               | Min    | Max    | Std Dev | CV%    | %Effect | Mean             | %Effect |
| 1.22      | N    | 3     | 0.5297             | 0.4243 | 0.5933 | 0.09193 | 17.36% | 0.0%    | 0.5297           | 0.0%    |
| 78        |      | 4     | 0.4133             | 0.37   | 0.4317 | 0.02941 | 7.12%  | 21.97%  | 0.4502           | 15.0%   |
| 154       |      | 4     | 0.4724             | 0.3878 | 0.598  | 0.09862 | 20.87% | 10.81%  | 0.4502           | 15.0%   |
| 326.33    |      | 4     | 0.465              | 0.364  | 0.6025 | 0.1048  | 22.55% | 12.22%  | 0.4502           | 15.0%   |

## Mean Dry Weight-mg Detail

| Conc-mg/L | Code | Rep 1  | Rep 2  | Rep 3  | Rep 4  |
|-----------|------|--------|--------|--------|--------|
| 1.22      | N    | 0.5714 | 0.5933 | 0.4243 |        |
| 78        |      | 0.4317 | 0.37   | 0.42   | 0.4317 |
| 154       |      | 0.3878 | 0.598  | 0.504  | 0.4    |
| 326.33    |      | 0.6025 | 0.4067 | 0.364  | 0.4867 |

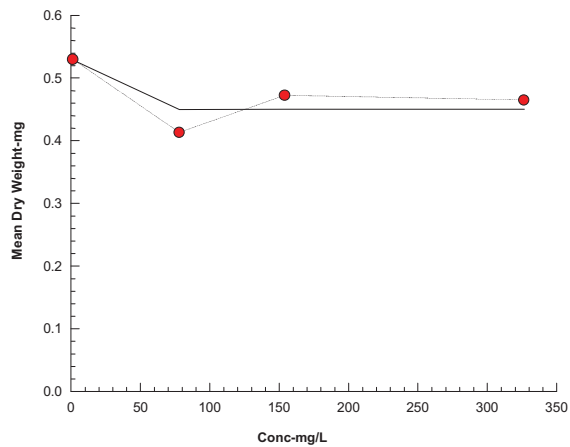


CETIS Analytical Report

Report Date: 04 Dec-18 09:20 (p 2 of 2)  
Test Code/ID: SP1718-015 SW / 20-9482-9621

| Ephemeroptera (Mayfly) 28-d Test |                | Nautilus Environmental Calgary |                              |
|----------------------------------|----------------|--------------------------------|------------------------------|
| Analysis ID:                     | 08-8421-7815   | Endpoint:                      | Mean Dry Weight-mg           |
| Analized:                        | 04 Dec-18 9:20 | Analysis:                      | Linear Interpolation (ICPIN) |
|                                  |                | CETIS Version:                 | CETISv1.9.4                  |
|                                  |                | Status Level:                  | 1                            |

Graphics



## **APPENDIX B – Moderately Hard Water Toxicity Test Data**

---

Handwritten notes:  
wetter  
(m/w)

Client: Equilibrium Sample Reference: SP1718-015

| Date       | Day | Initials | Chem Cart | Fed        | Daily Data Review |
|------------|-----|----------|-----------|------------|-------------------|
| 2018/09/03 | 0   | UL       | 3         | hide       | KL                |
| 2018/09/04 | 1   | UL       | 2         | 0.5ml      | KL                |
| 2018/09/05 | 2   | ST/ML    | 3         | 0.5ml      | KL                |
| 2018/09/06 | 3   | ST       | 2         | 0.5ml      | EP                |
| 2018/09/07 | 4   | ST       | 2         | 1 skeletal | EP                |
| 2018/09/08 | 5   | ST       | 2         | 1ml        | UF                |
| 2018/09/09 | 6   | UL       | 3         | 2ml        | KL                |
| 2018/09/10 | 7   | UL       | 3         | 1ml        | KL                |
| 2018/09/11 | 8   | UL/CB    | 3         | hide       | ST                |
| 2018/09/12 | 9   | UL/ST    | 2         | hide       | SS                |
| 2018/09/13 | 10  | ST/CB    | 2         | hide       | FD                |
| 2018/09/14 | 11  | ST/CB    | 2         | hide       | FD                |
| 2018/09/15 | 12  | ST       | 2         | hide       | UF                |
| 2018/09/16 | 13  | CB       | 3         |            | EP                |
| 2018/09/17 | 14  | ST       | 3         |            | CB                |
| 2018/09/18 | 15  | UL/ST    | 3         |            | EP                |
| 2018/09/19 | 16  | ML/ST    | 2         |            | UF                |
| 2018/09/20 | 17  | ML/ST    | 3         |            | KL                |
| 2018/09/21 | 18  | UL/ST    | 2         |            | KL                |
| 2018/09/22 | 19  | UL       | 2         |            | KL                |
| 2018/09/23 | 20  | UL/ST    | 2         |            | CB                |
| 2018/09/24 | 21  | ST       | 2         |            | EP                |
| 2018/09/25 | 22  | ST/ML    | 2         |            | KL                |
| 2018/09/26 | 23  | UL/ST    | 2         |            | KL                |
| 2018/09/27 | 24  | UL       | 2         |            | KL                |
| 2018/09/28 | 25  | UL       | 2         |            | KL                |
| 2018/09/29 | 26  | UL       | 2         |            | KL                |
| 2018/09/30 | 27  | UL       | 2         |            | KL                |
| 2018/10/01 | 28  | ST       | 3         |            | KL                |

moved to IL part

corrected

Reviewed by: UL/ST

Date Reviewed:

2018/10/22 -  
2018/11/02

Water Type: mhw Client: Equilibrium Sample Reference: SP1718-015

**Water Chemistries**

| conc. (mg/L Cl) | Control       | 75 | 150 | 300 | 600 | 1200 |
|-----------------|---------------|----|-----|-----|-----|------|
| day             | New Solutions |    |     |     |     |      |

pH  
(units)

|    |     |     |     |     |     |     |
|----|-----|-----|-----|-----|-----|-----|
| 0  | 7.9 | 8.0 | 8.0 | 8.1 | 8.0 | 8.0 |
| 4  | 8.4 | 7.6 | 8.4 | 8.4 | 8.3 | 8.4 |
| 7  | 8.4 | 8.4 | 8.3 | 8.2 | 8.2 | X   |
| 9  | 8.3 | 8.4 | 8.3 | 8.3 | 8.1 |     |
| 11 | 8.4 | 8.3 | 8.2 | 8.1 | 8.1 |     |
| 14 | 8.1 | 8.0 | 7.0 | 7.0 | 8.1 |     |
| 16 | 8.3 | 8.1 | 8.1 | 8.1 | 8.1 |     |
| 18 | 8.2 | 7.2 | 8.2 | 8.1 | 8.1 |     |
| 21 | 8.2 | 8.1 | 8.1 | 8.1 | 8.1 |     |
| 23 | 8.3 | 8.2 | 8.2 | 8.1 | 8.0 |     |
| 25 | 7.8 | 7.8 | 7.8 | 7.8 | 7.8 |     |

EC  
(uS/cm)

|    |     |     |     |      |      |      |
|----|-----|-----|-----|------|------|------|
| 0  | 317 | 549 | 807 | 1239 | 1839 | 3840 |
| 4  | 320 | 547 | 853 | 1274 | 2280 | 3910 |
| 7  | 325 | 550 | 805 | 1312 | 2310 | X    |
| 9  | 320 | 533 | 791 | 1223 | 2140 |      |
| 11 | 380 | 565 | 812 | 1273 | 2200 |      |
| 14 | 364 | 578 | 913 | 1433 | 2460 |      |
| 16 | 401 | 590 | 903 | 1476 | 2500 |      |
| 18 | 320 | 528 | 768 | 1215 | 2150 |      |
| 21 | 374 | 547 | 783 | 1227 | 2130 |      |
| 23 | 318 | 582 | 747 | 1220 | 2050 |      |
| 25 | 339 | 546 | 783 | 1225 | 2180 |      |

Reviewed By:

MLB

Date Reviewed:

2018/10/22

2018/11/02



Water Type mhw Client: Equilibrium Sample Reference: SP1718-015

**Water Chemistries**

| conc. (mg/L Cl <sup>-</sup> ) | Control       | 75 | 150 | 300 | 600 | 1200 |
|-------------------------------|---------------|----|-----|-----|-----|------|
| day                           | New Solutions |    |     |     |     |      |

|        |    |     |     |     |     |     |     |
|--------|----|-----|-----|-----|-----|-----|-----|
| DO     | 0  | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 |
| (mg/L) | 4  | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 |
|        | 7  | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | X   |
|        | 9  | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 |     |
|        | 11 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 |     |
|        | 14 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 |     |
|        | 16 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 |     |
|        | 18 | 7.3 | 7.3 | 7.3 | 7.4 | 7.4 |     |
|        | 21 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 |     |
|        | 23 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 |     |
|        | 25 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 |     |
|        |    |     |     |     |     |     |     |
|        |    |     |     |     |     |     |     |

|      |    |    |    |    |    |    |    |
|------|----|----|----|----|----|----|----|
| Temp | 0  | 23 | 23 | 23 | 23 | 23 | 23 |
| (°C) | 4  | 23 | 23 | 23 | 23 | 23 | 23 |
|      | 7  | 23 | 23 | 23 | 23 | 23 | X  |
|      | 9  | 23 | 23 | 23 | 23 | 23 |    |
|      | 11 | 23 | 23 | 23 | 23 | 23 |    |
|      | 14 | 23 | 23 | 23 | 23 | 23 |    |
|      | 16 | 23 | 23 | 23 | 23 | 23 |    |
|      | 18 | 23 | 23 | 23 | 23 | 23 |    |
|      | 21 | 23 | 23 | 23 | 23 | 23 |    |
|      | 23 | 23 | 23 | 23 | 23 | 23 |    |
|      | 25 | 23 | 23 | 23 | 23 | 23 |    |
|      |    |    |    |    |    |    |    |
|      |    |    |    |    |    |    |    |

Reviewed By: allist

Date Reviewed: 2018/10/22 - 2018/11/02

Water Type: NHW Client: Equilibrium Sample Reference: SP1718-015

## Water Chemistries

|                               |               |    |     |     |     |      |
|-------------------------------|---------------|----|-----|-----|-----|------|
| conc. (mg/L Cl <sup>-</sup> ) | Control       | 75 | 150 | 300 | 600 | 1200 |
| day                           | Old Solutions |    |     |     |     |      |

pH  
(units)

|    |     |     |     |     |     |     |
|----|-----|-----|-----|-----|-----|-----|
| 4  | 7.6 | 8.2 | 8.3 | 8.3 | 8.3 | 8.2 |
| 7  | 8.3 | 8.4 | 8.3 | 8.3 | 8.2 | X   |
| 9  | 8.1 | 8.2 | 8.3 | 8.3 | 8.2 |     |
| 11 | 8.1 | 8.1 | 8.1 | 8.1 | 8.1 |     |
| 14 | 8.0 | 7.9 | 7.9 | 8.1 | 8.1 |     |
| 16 | 8.1 | 8.0 | 8.0 | 7.9 | 8.0 |     |
| 18 | 8.1 | 8.0 | 8.0 | 8.0 | 8.3 |     |
| 21 | 8.1 | 8.0 | 8.0 | 8.0 | 8.0 |     |
| 23 | 7.7 | 7.7 | 7.7 | 8.0 | 8.0 |     |
| 25 | 7.9 | 7.9 | 7.9 | 7.9 | 8.0 |     |
| 28 | /   | 8.1 | 8.2 | 8.3 | /   |     |
|    |     |     |     |     |     |     |
|    |     |     |     |     |     |     |
|    |     |     |     |     |     |     |

EC  
( $\mu\text{S}/\text{cm}$ )

|               |                |                |                |                 |                 |              |
|---------------|----------------|----------------|----------------|-----------------|-----------------|--------------|
| 4             | 337            | 555            | 799            | 1205            | 2120            | 3710         |
| 7             | <del>337</del> | <del>570</del> | <del>826</del> | <del>1131</del> | <del>2240</del> | <del>x</del> |
| 9             | <del>369</del> | <del>612</del> | <del>810</del> | <del>122</del>  | <del>2110</del> |              |
| 11            | 341            | 533            | 790            | 1235            | 2140            |              |
| 14            | 380            | 597            | 895            | 1400            | 2460            |              |
| 16            | 404            | 608            | 913            | 1442            | 2470            |              |
| 18            | 416            | 597            | 928            | 1494            | 2540            |              |
| 21            | 411            | 596            | 852            | 1311            | 2390            |              |
| 23            | 410            | 557            | 892            | 1347            | 2130            |              |
| <del>23</del> | 411            | 586            | 901            | 1337            | 2140            |              |
| 28            | /              | 546            | 800            | 1298            | /               |              |

\*See daily observations for DO and Temp of old solutions (taken daily)

Reviewed By:

Date Reviewed: 2d8110122  
2d8111b2



## DAILY TEST OBSERVATIONS

## SURVIVAL

[illegible]

Reviewed By:

1577

Date Reviewed:

Deny 26 Soc - (didn't do transition)  
Transition, day 27  
Nautilus Environmental (Calgary) Day 28  
+ killed by train  
Day 29

Written by: JP 2018/08/03

Uncontrolled Document  
SP1718-015



**DAILY TEST OBSERVATIONS**

Life Cycle Stage

| conc. (mg/L Cl) | Control |   |   |   | 75 |   |   |   | 150 |   |   |   | 300 |   |   |   | 600 |   |   |   | 1200 |   |   |   |
|-----------------|---------|---|---|---|----|---|---|---|-----|---|---|---|-----|---|---|---|-----|---|---|---|------|---|---|---|
|                 | A       | B | C | D | A  | B | C | D | A   | B | C | D | A   | B | C | D | A   | B | C | D | A    | B | C | D |
| Replicate day   |         |   |   |   |    |   |   |   |     |   |   |   |     |   |   |   |     |   |   |   |      |   |   |   |
| 1               | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 2               | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 3               | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 4               | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 5               | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 6               | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 7               | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 8               | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 9               | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 10              | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 11              | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 12              | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 13              | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 14              | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 15              | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 16              | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 17              | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 18              | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 19              | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 20              | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 21              | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 22              | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 23              | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 24              | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 25              | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 26              | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 27              | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 28              | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |

N=Nymph

PE = Pre-Emergent

SI = Sub-Imago

I = Imago

PE = Pre-Emergent

SI = Sub-Imago

I = Imago

Day 23-600A  
2 died during emergence  
75A-died during emergence  
150A-died during emergence  
Written by: JP 2018/08/03  
300 C-2 died during emergence

Reviewed By:

Day 23-600A  
Day 23-75A  
Day 23-150A  
Day 23-300A

Day 23-600A  
Day 23-75A  
Day 23-150A  
Day 23-300A

Day 23-600A  
Day 23-75A  
Day 23-150A  
Day 23-300A

Day 23-600A  
Day 23-75A  
Day 23-150A  
Day 23-300A

Day 23-600A  
Day 23-75A  
Day 23-150A  
Day 23-300A



Water Type

nnhww

Client: Equilibrium

Sample Reference:

SP1718-015

## DAILY TEST OBSERVATIONS

DO (%) 80 - 100% saturation

| conc. (mg/L Cl <sup>-</sup> ) | Control |     |     |     | 75  |     |     |     | 150 |     |     |     | 300 |     |     |     | 600 |     |     |     | 1200 |     |     |     |
|-------------------------------|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|-----|-----|-----|
| Replicate day                 | A       | B   | C   | D   | A   | B   | C   | D   | A   | B   | C   | D   | A   | B   | C   | D   | A   | B   | C   | D   | A    | B   | C   | D   |
| 1                             | 7.9     | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9  | 7.9 | 7.9 | 7.9 |
| 2                             | 7.9     | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9  | 7.9 | 7.9 | 7.9 |
| 3                             | 7.9     | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9  | 7.9 | 7.9 | 7.9 |
| 4                             | 7.9     | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9  | 7.9 | 7.9 | 7.9 |
| 5                             | 7.9     | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9  | 7.9 | 7.9 | 7.9 |
| 6                             | 7.9     | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9  | 7.9 | 7.9 | 7.9 |
| 7                             | 7.9     | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9  | 7.9 | 7.9 | 7.9 |
| 8                             | 7.9     | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9  | 7.9 | 7.9 | 7.9 |
| 9                             | 7.9     | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9  | 7.9 | 7.9 | 7.9 |
| 10                            | 7.9     | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9  | 7.9 | 7.9 | 7.9 |
| 11                            | 7.9     | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9  | 7.9 | 7.9 | 7.9 |
| 12                            | 7.9     | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9  | 7.9 | 7.9 | 7.9 |
| 13                            | 7.9     | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9  | 7.9 | 7.9 | 7.9 |
| 14                            | 7.9     | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9  | 7.9 | 7.9 | 7.9 |
| 15                            | 7.9     | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9  | 7.9 | 7.9 | 7.9 |
| 16                            | 7.9     | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9  | 7.9 | 7.9 | 7.9 |
| 17                            | 7.9     | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9  | 7.9 | 7.9 | 7.9 |
| 18                            | 7.9     | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9  | 7.9 | 7.9 | 7.9 |
| 19                            | 7.9     | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9  | 7.9 | 7.9 | 7.9 |
| 20                            | 7.9     | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9  | 7.9 | 7.9 | 7.9 |
| 21                            | 7.9     | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9  | 7.9 | 7.9 | 7.9 |
| 22                            | 7.9     | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9  | 7.9 | 7.9 | 7.9 |
| 23                            | 7.9     | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9  | 7.9 | 7.9 | 7.9 |
| 24                            | 7.9     | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9  | 7.9 | 7.9 | 7.9 |
| 25                            | 7.9     | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9  | 7.9 | 7.9 | 7.9 |
| 26                            | 7.9     | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9  | 7.9 | 7.9 | 7.9 |
| 27                            | 7.9     | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9  | 7.9 | 7.9 | 7.9 |
| 28                            | 7.9     | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9 | 7.9  | 7.9 | 7.9 | 7.9 |

Reviewed By:

7.4

7.4

Date Reviewed: Day 27 + 28 DO for 30.2

7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4

lighting added



Water Type

Client: NAWU

Equilibrium

Sample Reference:

SP1718-015

**DAILY TEST OBSERVATIONS**

Temperature (°C) - 24 +/- 1

| conc. (mg/L Cl) | Control |   |   |   | 75 |   |   |   | 150 |   |   |   | 300 |   |   |   | 600 |    |    |   | 1200 |    |    |   |
|-----------------|---------|---|---|---|----|---|---|---|-----|---|---|---|-----|---|---|---|-----|----|----|---|------|----|----|---|
|                 | A       | B | C | D | A  | B | C | D | A   | B | C | D | A   | B | C | D | A   | B  | C  | D | A    | B  | C  | D |
| 1               | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 24  | 25 | 25 |   | 25   | 25 | 25 |   |
| 2               | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |    |    |   | 23   |    |    |   |
| 3               | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |    |    |   | 23   |    |    |   |
| 4               | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |    |    |   | 23   |    |    |   |
| 5               | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |    |    |   | 23   |    |    |   |
| 6               | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 24  |    |    |   | 24   |    |    |   |
| 7               | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |    |    |   | 23   |    |    |   |
| 8               | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |    |    |   | 23   |    |    |   |
| 9               | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |    |    |   | 23   |    |    |   |
| 10              | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |    |    |   | 23   |    |    |   |
| 11              | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |    |    |   | 23   |    |    |   |
| 12              | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |    |    |   | 23   |    |    |   |
| 13              | 24      |   |   |   | 24 |   |   |   | 24  |   |   |   | 24  |   |   |   | 24  |    |    |   | 24   |    |    |   |
| 14              | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |    |    |   | 23   |    |    |   |
| 15              | 24      |   |   |   | 24 |   |   |   | 24  |   |   |   | 24  |   |   |   | 24  |    |    |   | 24   |    |    |   |
| 16              | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |    |    |   | 23   |    |    |   |
| 17              | 24      |   |   |   | 24 |   |   |   | 24  |   |   |   | 24  |   |   |   | 24  |    |    |   | 24   |    |    |   |
| 18              | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |    |    |   | 23   |    |    |   |
| 19              | 24      |   |   |   | 24 |   |   |   | 24  |   |   |   | 24  |   |   |   | 24  |    |    |   | 24   |    |    |   |
| 20              | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |    |    |   | 23   |    |    |   |
| 21              | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |    |    |   | 23   |    |    |   |
| 22              | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |    |    |   | 23   |    |    |   |
| 23              | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |    |    |   | 23   |    |    |   |
| 24              | 24      |   |   |   | 24 |   |   |   | 24  |   |   |   | 24  |   |   |   | 24  |    |    |   | 24   |    |    |   |
| 25              | 24      |   |   |   | 24 |   |   |   | 24  |   |   |   | 24  |   |   |   | 24  |    |    |   | 24   |    |    |   |
| 26              | 24      |   |   |   | 24 |   |   |   | 24  |   |   |   | 24  |   |   |   | 24  |    |    |   | 24   |    |    |   |
| 27              | 24      |   |   |   | 24 |   |   |   | 24  |   |   |   | 24  |   |   |   | 24  |    |    |   | 24   |    |    |   |
| 28              | 24      |   |   |   | 24 |   |   |   | 24  |   |   |   | 24  |   |   |   | 24  |    |    |   | 24   |    |    |   |

Reviewed By: allst

Date Reviewed: 2018/10/22



# Comment Summary

 Client: \_\_\_\_\_  
 Client #: \_\_\_\_\_

 Sample #: Nttw  
 Test #: \_\_\_\_\_

 Date: \_\_\_\_\_  
 Initials: \_\_\_\_\_

Day 4 - moved to IL jars

Day 21 - 300D → 1 died emerging

Day 23 - 300B → 1 died in PE

Day 24 - 7SB → 1 died in PE

Day 25 - 300B → 1 killed by tech\* (out of 9)

Day 26 - 150A → 1 died emerging

- 300D → 1 died emerging

- 150C → 1 didn't transition, died day 27 = transitioned

- 600A → 1 died emerging

Day 27 - 7SC

150B → 1 died emerging

150D

Day 28 - 7SA - 1 died as PE

- 150A - 2 died as PE

- 300A - 1 died as PE

- 300C - 2 died emerging (from day 26)

- 600A - 1 died emerging

Day 29 - 300G - 1 died as PE

Concentration: NHW-CTL

 Day: 18 Initials: NLIST Date: 2018/09/21

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 10                  | 0              | 0                          | /                           | 0                     | 10                      | 10             |
| B     | 9                   | 0              | 0                          | /                           | 0                     | 8                       | 9              |
| C     | 8                   | 0              | 0                          | /                           | 0                     | 8                       | 8              |
| D     | 10                  | 0              | 0                          | /                           | 0                     | 10                      | 10             |

 Day: 19 Initials: NL Date: 2018/09/22

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 10                  | 0              | 0                          | 0                           | 0                     | 10                      | 10             |
| B     | 8                   | 0              | 0                          | 0                           | 0                     | 8                       | 9              |
| C     | 8                   | 1              | 0                          | 0                           | 0                     | 7                       | 8              |
| D     | 10                  | 0              | 0                          | 0                           | 0                     | 10                      | 10             |

 Day: 20 Initials: NLIST Date: 2018/09/23

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 10                  | 1              | 1                          | 0                           | 0                     | 9                       | 10             |
| B     | 8                   | 0              | 0                          | 0                           | 1                     | 8                       | 9              |
| C     | 7                   | 1              | 1                          | 0                           | 0                     | 6                       | 8              |
| D     | 10                  | 2              | 2                          | 0                           | 0                     | 8                       | 10             |

 Day: 21 Initials: ST Date: 2018/09/24

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 9                   | 1              | 1                          | 0                           | 1                     | 8                       | 10             |
| B     | 8                   | 0              | 0                          | 0                           | 1                     | 8                       | 9              |
| C     | 6                   | 1              | 1                          | 1                           | 2                     | 5                       | 8              |
| D     | 8                   | 2              | 2                          | 2                           | 2                     | 6                       | 10             |

 Day: 22 Initials: NLIST Date: 2018/09/25

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 8                   | 2              | 2                          | 1                           | 2                     | 6                       | 10             |
| B     | 8                   | 1              | 1                          | 0                           | 2                     | 7                       | 9              |
| C     | 5                   | 0              | 0                          | 1                           | 3                     | 4                       | 8              |
| D     | 5                   | 0              | 0                          | 2                           | 4                     | 5                       | 9              |



Concentration:

Mitw-CTL

Day:

23

Initials:

MLIST

Date:

2018/09/26

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 6                   | 4              | 4                          | 2                           | 4                     | 2                       | 10             |
| B     | 7                   | 5              | 5                          | 1                           | 2                     | 2                       | 9              |
| C     | 4                   | 2              | 2                          | 0                           | 4                     | 2                       | 8              |
| D     | 5                   | 4              | 4                          | 0                           | 4                     | 1                       | 9              |

Day:

24

Initials:

ML

Date:

2018/09/27

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 2                   | 1              | 1                          | 4                           | 8                     | 1                       | 10             |
| B     | 2                   | 1              | 1                          | 5                           | 7                     | 1                       | 9              |
| C     | 2                   | 0              | 0                          | 2                           | 6                     | 1                       | 8              |
| D     | 1                   | 0              | 0                          | 4                           | 8                     | 1                       | 9              |

Day:

25

Initials:

ML

Date:

2018/09/28

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 1                   | 0              | 0                          | 1                           | 9                     | 1                       | 10             |
| B     | 1                   | 1              | 0                          | 1                           | 8                     | 0                       | 9              |
| C     | 1                   | 0              | 0                          | 0                           | 7                     | 0                       | 8              |
| D     | 1                   | 0              | 0                          | 0                           | 8                     | 1                       | 9              |

Day:

26

Initials:

ML

Date:

2018/09/29

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 0                   | 0              | 0                          | 0                           | 9                     | 0                       | 9              |
| B     | 1                   | 1              | 0                          | 0                           | 9                     | 0                       | 9              |
| C     | 1                   | 1              | 0                          | 0                           | 8                     | 1                       | 8              |
| D     | 1                   | 1              | 1                          | 0                           | 8                     | 0                       | 9              |

Day:

27

Initials:

ML

Date:

2018/09/30

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | /                   | /              | 0                          | 0                           | 9                     | /                       | 9              |
| B     | /                   | /              | 0                          | 0                           | 9                     | /                       | 9              |
| C     | /                   | /              | 0                          | 0                           | 8                     | /                       | 8              |
| D     | /                   | /              | 1                          | 1                           | 9                     | /                       | 9              |

Concentration:

MHW-CTZ

Day:

28

Initials:

ML

Date:

2018/10/01

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | /                   | /              | /                          | /                           | 9                     | /                       | 9              |
| B     | /                   | /              | /                          | /                           | 9                     | /                       | 9              |
| C     | /                   | /              | /                          | /                           | 8                     | /                       | 8              |
| D     | /                   | /              | /                          | /                           | 9                     | /                       | 9              |

Day:

29

Initials:

ST

Date:

2018/10/02

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | /                   | /              | /                          | /                           | 9                     | /                       | 9              |
| B     | /                   | /              | /                          | /                           | 9                     | /                       | 9              |
| C     | /                   | /              | /                          | /                           | 8                     | /                       | 8              |
| D     | /                   | /              | /                          | /                           | 9                     | /                       | 9              |

Day:

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     |                     |                |                            |                             |                       |                         |                |

Day:

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     |                     |                |                            |                             |                       |                         |                |

Day:

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     |                     |                |                            |                             |                       |                         |                |



Concentration: MHW-75

 Day: 18 Initials: — Date: —

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 9                   | 0              | 0                          | 0                           | 0                     | 9                       | 9              |
| B     | 8                   | 0              | 0                          | 0                           | 0                     | 8                       | 8              |
| C     | 10                  | 0              | 0                          | 0                           | 0                     | 10                      | 10             |
| D     | 10                  | 0              | 0                          | 0                           | 0                     | 10                      | 10             |

 Day: 19 Initials: — Date: —

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 9                   | 0              | 0                          | 0                           | 0                     | 9                       | 9              |
| B     | 8                   | 0              | 0                          | 0                           | 0                     | 8                       | 8              |
| C     | 10                  | 0              | 0                          | 0                           | 0                     | 10                      | 10             |
| D     | 10                  | 0              | 0                          | 0                           | 0                     | 10                      | 10             |

 Day: 20 Initials: — Date: —

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 9                   | 1              | 1                          | 0                           | 0                     | 8                       | 9              |
| B     | 8                   | 1              | 1                          | 0                           | 0                     | 7                       | 8              |
| C     | 10                  | 0              | 0                          | 0                           | 0                     | 9                       | 10             |
| D     | 10                  | 0              | 0                          | 0                           | 0                     | 10                      | 10             |

 Day: 21 Initials: — Date: —

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 8                   | 0              | 0                          | 1                           | 1                     | 8                       | 9              |
| B     | 7                   | 0              | 0                          | 1                           | 1                     | 8                       | 8              |
| C     | 9                   | 1              | 1                          | 0                           | 0                     | 8                       | 10             |
| D     | 8                   | 1              | 1                          | 0                           | 0                     | 7                       | 8              |

 Day: 22 Initials: — Date: —

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 8                   | 2              | 2                          | 0                           | 1                     | 6                       | 9              |
| B     | 6                   | 1              | 1                          | 0                           | 2                     | 5                       | 8              |
| C     | 8                   | 0              | 0                          | 1                           | 2                     | 6                       | 10             |
| D     | 7                   | 0              | 0                          | 1                           | 1                     | 7                       | 8              |

Concentration:

MHW-75

Day:

23

Initials:

—

Date:

—

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 6                   | 2              | 2                          | 2                           | 3                     | 4                       | 9              |
| B     | 5                   | 2              | 2                          | 1                           | 3                     | 3                       | 8              |
| C     | 8                   | 2              | 2                          | 0                           | 2                     | 6                       | 10             |
| D     | 7                   | 4              | 4                          | 0                           | 1                     | 3                       | 8              |

Day:

24

Initials:

—

Date:

—

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 4                   | 2              | 2                          | 2                           | 5                     | 2                       | 9              |
| B     | 3                   | 1              | 1                          | 1                           | 4                     | 2                       | 7              |
| C     | 6                   | 0              | 0                          | 2                           | 4                     | 6                       | 10             |
| D     | 3                   | 2              | 2                          | 4                           | 5                     | 1                       | 8              |

Day:

25

Initials:

—

Date:

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| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 2                   | 1              | 1                          | 2                           | 7                     | 1                       | 9              |
| B     | 2                   | 2              | 2                          | 1                           | 5                     | 0                       | 7              |
| C     | 6                   | 3              | 3                          | 0                           | 4                     | 3                       | 10             |
| D     | 1                   | 1              | 1                          | 2                           | 7                     | 0                       | 8              |

Day:

26

Initials:

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Date:

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| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 1                   | 0              | 0                          | 1                           | 8                     | 1                       | 9              |
| B     | 1                   | 0              | 0                          | 2                           | 7                     | 1                       | 7              |
| C     | 3                   | 2              | 2                          | 3                           | 7                     | 1                       | 10             |
| D     | 1                   | 1              | 1                          | 1                           | 8                     | 1                       | 8              |

Day:

27

Initials:

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Date:

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| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 1                   | 1              | 1                          | 0                           | 8                     | 0                       | 9              |
| B     | 1                   | 1              | 1                          | 0                           | 7                     | 0                       | 7              |
| C     | 1                   | 0              | 0                          | 1                           | 8                     | 1                       | 9              |
| D     | 1                   | 1              | 1                          | 1                           | 8                     | 1                       | 8              |



Concentration: Mitw - 75

 Day: 28 Initials: — Date: —

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 1                   | 1              | 1                          | 0                           | 8                     | 1                       | 8              |
| B     | 1                   | 1              | 1                          | 0                           | 8                     | 1                       | 8              |
| C     | 1                   | 0              | 0                          | 0                           | 8                     | 1                       | 8              |
| D     | 1                   | 1              | 1                          | 1                           | 8                     | 1                       | 8              |

 Day: 29 Initials: — Date: —

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | /                   | /              | /                          | /                           | 8                     | /                       | 8              |
| B     | /                   | /              | /                          | /                           | 8                     | /                       | 8              |
| C     | /                   | /              | /                          | /                           | 8                     | /                       | 8              |
| D     | /                   | /              | /                          | /                           | 8                     | /                       | 8              |

4 nymph

 Day: — Initials: — Date: —

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     |                     |                |                            |                             |                       |                         |                |

 Day: — Initials: — Date: —

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     |                     |                |                            |                             |                       |                         |                |

 Day: — Initials: — Date: —

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     |                     |                |                            |                             |                       |                         |                |

Concentration:

MHW-150

Day:

18

Initials:

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Date:

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| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 10                  | 0              | 0                          | —                           | 0                     | 10                      | 10             |
| B     | 9                   | ↓              | ↓                          | —                           | ↓                     | 9                       | 9              |
| C     | 9                   | ↓              | ↓                          | —                           | ↓                     | 9                       | 9              |
| D     | 7                   | ↓              | ↓                          | —                           | ↓                     | 7                       | 7              |

Day:

19

Initials:

—

Date:

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| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 10                  | 0              | 0                          | 0                           | 0                     | 10                      | 10             |
| B     | 9                   | ↓              | ↓                          | ↓                           | ↓                     | 9                       | 9              |
| C     | 9                   | ↓              | ↓                          | ↓                           | ↓                     | 9                       | 9              |
| D     | 7                   | ↓              | ↓                          | ↓                           | ↓                     | 7                       | 7              |

Day:

20

Initials:

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Date:

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| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 10                  | 1              | 1                          | 0                           | 0                     | 9                       | 10             |
| B     | 9                   | 0              | 0                          | 0                           | 0                     | 9                       | 9              |
| C     | 8                   | 0              | 0                          | ↓                           | ↓                     | 8                       | 8              |
| D     | 7                   | 1              | 1                          | ↓                           | ↓                     | 6                       | 7              |

Day:

21

Initials:

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Date:

—

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 9                   | 1              | 1                          | 1                           | 1                     | 8                       | 10             |
| B     | 9                   | 1              | 1                          | 0                           | 0                     | 8                       | 9              |
| C     | 8                   | 0              | 0                          | 0                           | 0                     | 8                       | 8              |
| D     | 6                   | 1              | 1                          | 1                           | 1                     | 5                       | 7              |

Day:

22

Initials:

—

Date:

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| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 8                   | 0              | 0                          | 1                           | 2                     | 8                       | 10             |
| B     | 8                   | ↓              | ↓                          | 1                           | 1                     | 8                       | 9              |
| C     | 6                   | ↓              | ↓                          | 0                           | 0                     | 6                       | 6              |
| D     | 5                   | ↓              | ↓                          | 1                           | 2                     | 5                       | 7              |



Concentration:

MHW-150

Day:

23

Initials:

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Date:

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| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 8                   | 1              | 1                          | 0                           | 2                     | 7                       | 10             |
| B     | 7                   | 0              | 0                          | 0                           | 1                     | 7                       | 8              |
| C     | 6                   | 2              | 2                          | 1                           | 0                     | 4                       | 6              |
| D     | 5                   | 1              | 1                          | 1                           | 2                     | 4                       | 7              |

Day:

24

Initials:

—

Date:

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| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 7                   | 2              | 2                          | 1                           | 3                     | 5                       | 10             |
| B     | 7                   | 1              | 1                          | 0                           | 1                     | 6                       | 8              |
| C     | 4                   | 2              | 2                          | 2                           | 2                     | 2                       | 6              |
| D     | 4                   | 1              | 1                          | 1                           | 3                     | 3                       | 7              |

Day:

25

Initials:

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Date:

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| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 5                   | 1              | 1                          | 2                           | 5                     | 4                       | 10             |
| B     | 6                   | 1              | 1                          | 1                           | 2                     | 5                       | 8              |
| C     | 2                   | 2              | 2                          | 2                           | 4                     | 0                       | 6              |
| D     | 3                   | 1              | 1                          | 1                           | 4                     | 2                       | 7              |

Day:

26

Initials:

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Date:

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| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 4                   | 0              | 0                          | 0                           | 5                     | 4                       | 9              |
| B     | 4                   | 3              | 3                          | 1                           | 3                     | 1                       | 7              |
| C     | 1                   | 3              | 3                          | 2                           | 6                     | 0                       | 6              |
| D     | 2                   | 2              | 2                          | 1                           | 5                     | 0                       | 7              |

Day:

27

Initials:

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Date:

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\*transferred day 27, 1 day later

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 4                   | 3              | 3                          | 0                           | 5                     | 1                       | 9              |
| B     | 1                   | 0              | 0                          | 2                           | 5                     | 1                       | 6              |
| C     | 1                   | 1              | 1                          | 1                           | 6                     | 1                       | 6              |
| D     | 0                   | 1              | 1                          | 1                           | 6                     | 1                       | 6              |

Concentration: NH<sub>4</sub>W-ISO

Day: 28 Initials: — Date: —

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 1                   | 0              | 0                          | 0                           | 0                     | 0                       | 1              |
| B     | 1                   | 0              | 0                          | 0                           | 0                     | 0                       | 1              |
| C     | 1                   | 1              | 1                          | 1                           | 0                     | 1                       | 0              |
| D     | 1                   | 1              | 1                          | 1                           | 0                     | 1                       | 0              |

Day: 29 Initials: — Date: —

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | /                   | /              | /                          | 0                           | 7                     | /                       | 7              |
| B     | /                   | /              | /                          | 0                           | 5                     | /                       | 6 (nymphs)     |
| C     | /                   | /              | /                          | 1                           | 0                     | /                       | 0              |
| D     | /                   | /              | /                          | 1                           | 0                     | /                       | 0              |

Day: — Initials: — Date: —

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     |                     |                |                            |                             |                       |                         |                |

Day: — Initials: — Date: —

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     |                     |                |                            |                             |                       |                         |                |

Day: — Initials: — Date: —

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     |                     |                |                            |                             |                       |                         |                |



Concentration:

MHW-300

Day:

18

Initials:

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Date:

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| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 9                   | 0              | 0                          | /                           | 0                     | 9                       | 9              |
| B     | 9                   | 0              | 0                          |                             | 0                     | 9                       | 9              |
| C     | 9                   | 0              | 0                          |                             | 0                     | 9                       | 9              |
| D     | 9                   | 0              | 0                          |                             | 0                     | 9                       | 9              |

Day:

19

Initials:

—

Date:

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| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 9                   | 0              | 0                          | 0                           | 0                     | 9                       | 9              |
| B     | 8                   | 0              | 0                          | 0                           | 0                     | 8                       | 8              |
| C     | 9                   | 0              | 0                          | 0                           | 0                     | 9                       | 9              |
| D     | 9                   | 0              | 0                          | 0                           | 0                     | 9                       | 9              |

Day:

20

Initials:

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Date:

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| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 9                   | 0              | 0                          | 0                           | 0                     | 9                       | 9              |
| B     | 8                   | 0              | 0                          | 0                           | 0                     | 8                       | 8              |
| C     | 9                   | 0              | 0                          | 0                           | 0                     | 9                       | 9              |
| D     | 8                   | 0              | 0                          | 0                           | 0                     | 8                       | 8              |

Day:

21

Initials:

—

Date:

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| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 8                   | 0              | 0                          | 0                           | 0                     | 8                       | 8              |
| B     | 8                   | 0              | 0                          | 0                           | 0                     | 8                       | 8              |
| C     | 9                   | 0              | 0                          | 0                           | 0                     | 9                       | 9              |
| D     | 6                   | 0              | 0                          | 0                           | 0                     | 6                       | 6              |

Day:

22

Initials:

—

Date:

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| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 8                   | 2              | 2                          | 0                           | 0                     | 6                       | 8              |
| B     | 8                   | 1              | 1                          | 0                           | 0                     | 7                       | 8              |
| C     | 9                   | 2              | 2                          | 0                           | 0                     | 7                       | 9              |
| D     | 6                   | 0              | 0                          | 0                           | 0                     | 6                       | 6              |

Concentration: MHW-300

 Day: 23 Initials: — Date: —

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 6                   | 0              | 0                          | 3                           | 3                     | 6                       | 8              |
| B     | 7                   | 0              | 0                          | 3                           | 3                     | 6                       | 7              |
| C     | 7                   | 0              | 0                          | 3                           | 3                     | 7                       | 9              |
| D     | 6                   | 0              | 0                          | 3                           | 1                     | 5                       | 7              |

 Day: 24 Initials: — Date: —

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 6                   | 0              | 0                          | 0                           | 2                     | 5                       | 8              |
| B     | 6                   | 0              | 0                          | 0                           | 2                     | 6                       | 7              |
| C     | 7                   | 0              | 0                          | 0                           | 2                     | 6                       | 9              |
| D     | 5                   | 0              | 0                          | 0                           | 2                     | 5                       | 7              |

 Day: 25 Initials: — Date: —

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 4                   | 0              | 0                          | 0                           | 3                     | 4                       | 7              |
| B     | 4                   | 0              | 0                          | 0                           | 1                     | 1                       | 5              |
| C     | 6                   | 1              | 1                          | 0                           | 3                     | 5                       | 9              |
| D     | 5                   | 2              | 2                          | 0                           | 2                     | 3                       | 7              |

 Day: 26 Initials: x killed by tech. Date: —

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 4                   | 1              | 1                          | 0                           | 3                     | 3                       | 7              |
| B     | 1                   | 1              | 1                          | 3                           | 4                     | 0                       | 5              |
| C     | 5                   | 2              | 2                          | 1                           | 4                     | 3                       | 9              |
| D     | 3                   | 1              | 1                          | 1                           | 3                     | 2                       | 6              |

 Day: 27 Initials: — Date: —

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 3                   | 2              | 2                          | 1                           | 4                     | 1                       | 7              |
| B     | 3                   | —              | —                          | 1                           | 5                     | 1                       | 5              |
| C     | 3                   | 0              | 0                          | 0                           | 4                     | 2                       | 7              |
| D     | 1                   | 0              | 0                          | 1                           | 4                     | 1                       | 5              |



Concentration:

NHw-300

Day:

28

Initials:

—

Date:

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| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 1                   | 1              | 1                          | 1                           | 5                     | 0                       | 6              |
| B     | 1                   | 1              | 1                          | 1                           | 5                     | 0                       | 5              |
| C     | 2                   | 2              | 2                          | 1                           | 5                     | 0                       | 5              |
| D     | 1                   | 0              | 0                          | 0                           | 4                     | 1                       | 5              |

Day:

29

Initials:

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Date:

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| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | /                   | /              | /                          | 1                           | 6                     | /                       | 6              |
| B     | /                   | /              | /                          | 1                           | 5                     | /                       | 5              |
| C     | /                   | /              | /                          | 1                           | 5                     | /                       | 5              |
| D     | /                   | /              | /                          | 0                           | 4                     | /                       | 5 (1 nymph)    |

Day:

—

Initials:

—

Date:

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| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     |                     |                |                            |                             |                       |                         |                |

Day:

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Initials:

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Date:

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| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 1                   |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     | 1                   |                |                            |                             |                       |                         |                |

Day:

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Initials:

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Date:

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| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     |                     |                |                            |                             |                       |                         |                |

Concentration:

MHW-600

Day:

18

Initials:

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Date:

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| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 3                   | 0              | 0                          | /                           | 0                     | 3                       | 3              |
| B     | 2                   | 0              | 0                          | /                           | 0                     | 2                       | 2              |
| C     | 4                   | ↓              | ↓                          | /                           | ↓                     | 4                       | 4              |
| D     | 1                   | ↓              | ↓                          | /                           | ↓                     | 1                       | 1              |

Day:

19

Initials:

—

Date:

—

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 3                   | 0              | 0                          | /                           | 0                     | 3                       | 3              |
| B     | 2                   | 0              | 0                          | /                           | 0                     | 2                       | 2              |
| C     | 3                   | ↓              | ↓                          | /                           | ↓                     | 3                       | 3              |
| D     | 1                   | ↓              | ↓                          | /                           | ↓                     | 1                       | 1              |

Day:

20

Initials:

—

Date:

—

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 3                   | 0              | 0                          | /                           | 0                     | 3                       | 3              |
| B     | 2                   | 0              | 0                          | /                           | 0                     | 2                       | 2              |
| C     | 3                   | ↓              | ↓                          | /                           | ↓                     | 3                       | 3              |
| D     | 1                   | ↓              | ↓                          | /                           | ↓                     | 1                       | 1              |

Day:

21

Initials:

—

Date:

—

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 3                   | 0              | 0                          | /                           | 0                     | 3                       | 3              |
| B     | 2                   | 0              | 0                          | /                           | 0                     | 2                       | 2              |
| C     | 3                   | ↓              | ↓                          | /                           | ↓                     | 3                       | 3              |
| D     | 1                   | ↓              | ↓                          | /                           | ↓                     | 1                       | 1              |

Day:

22

Initials:

—

Date:

—

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 3                   | 0              | 0                          | /                           | 0                     | 3                       | 3              |
| B     | 2                   | 0              | 0                          | /                           | 0                     | 2                       | 2              |
| C     | 3                   | ↓              | ↓                          | /                           | ↓                     | 3                       | 3              |
| D     | 1                   | ↓              | ↓                          | /                           | ↓                     | 1                       | 1              |



Concentration:

MTW 200

Day:

23

Initials:

—

Date:

—

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 3                   | 0              | 0                          | <del>0</del>                | 0                     | 3                       | 3              |
| B     | 2                   | 0              | 0                          | <del>0</del>                | 0                     | 2                       | 2              |
| C     | 3                   | 0              | 0                          | <del>0</del>                | 0                     | 3                       | 3              |
| D     | 3                   | 0              | 0                          | <del>0</del>                | 0                     | 3                       | 3              |

Day:

24

Initials:

—

Date:

—

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 3                   | 1              | 1                          | <del>0</del>                | 0                     | 2                       | 3              |
| B     | 2                   | 1              | 1                          | <del>0</del>                | 0                     | 1                       | 2              |
| C     | 3                   | 0              | 0                          | <del>0</del>                | 0                     | 3                       | 3              |
| D     | 1                   | 0              | 0                          | <del>0</del>                | 0                     | 1                       | 1              |

Day:

25

Initials:

—

Date:

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| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 2                   | 1              | 1                          | 1                           | 1                     | 1                       | 3              |
| B     | 1                   | 1              | 1                          | 1                           | 1                     | 0                       | 2              |
| C     | 3                   | 0              | 0                          | 0                           | 0                     | 2                       | 3              |
| D     | 1                   | 0              | 0                          | 0                           | 0                     | 1                       | 1              |

Day:

26

Initials:

—

Date:

—

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 1                   | 0              | 0                          | 0                           | 1                     | 1                       | 2              |
| B     | 1                   | 0              | 0                          | 0                           | 2                     | 1                       | 2              |
| C     | 2                   | 1              | 1                          | 0                           | 0                     | 0                       | 3              |
| D     | 1                   | 1              | 1                          | 0                           | 0                     | 0                       | 1              |

Day:

27

Initials:

—

Date:

—

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 1                   | 1              | 1                          | 0                           | 1                     | 0                       | 2              |
| B     | 1                   | 1              | 1                          | 0                           | 2                     | 0                       | 2              |
| C     | 1                   | 1              | 1                          | 1                           | 2                     | 0                       | 3              |
| D     | 1                   | 1              | 1                          | 1                           | 1                     | 1                       | 1              |



Concentration: 1000

 Day: 28 Initials: \_\_\_\_\_ Date: \_\_\_\_\_

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | /                   | /              | /                          | 0                           | 1                     | /                       | 1              |
| B     | /                   | /              | /                          | 1                           | 1                     | /                       | 2              |
| C     | /                   | /              | /                          | 1                           | 3                     | /                       | 3              |
| D     | /                   | /              | /                          | 1                           | 1                     | /                       | 2              |

 Day: 29 Initials: \_\_\_\_\_ Date: \_\_\_\_\_

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | /                   | /              | /                          | 1                           | 1                     | /                       | 2              |
| B     | /                   | /              | /                          | 2                           | 2                     | /                       | 4              |
| C     | /                   | /              | /                          | 3                           | 3                     | /                       | 6              |
| D     | /                   | /              | /                          | 1                           | 1                     | /                       | 2              |

Day: \_\_\_\_\_ Initials: \_\_\_\_\_ Date: \_\_\_\_\_

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     |                     |                |                            |                             |                       |                         |                |

Day: \_\_\_\_\_ Initials: \_\_\_\_\_ Date: \_\_\_\_\_

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     |                     |                |                            |                             |                       |                         |                |

Day: \_\_\_\_\_ Initials: \_\_\_\_\_ Date: \_\_\_\_\_

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     |                     |                |                            |                             |                       |                         |                |

NAHU

Client NAHU01

Sample SP1718-015 Organism MA

Batch                     

Initial Weight (mg):  
Final Weight (mg):

| Item Weighed          | Date     | Initials | Balance* |
|-----------------------|----------|----------|----------|
| dried pan             | 20120718 | ST       | Molly    |
| dried pan + organisms | 20121013 | LL       | NAHU     |

Concentration

\* same balance must be used for initial and final weights  
\* for FM/HA/CT, must use scale with 0.01 mg accuracy

~~|           |         |       |
|-----------|---------|-------|
| Replicate | Initial | Final |
| a         | 990.29  |       |
| b         | 995.98  |       |
| c         | 998.98  |       |
| d         | 993.98  |       |
| e         |         |       |~~
~~|         |        |
|---------|--------|
| Initial | Final  |
| 991.74  | 994.84 |
| 989.62  | 993.94 |
| 990.61  | 994.11 |
| 990.84  | 995.06 |~~
~~|         |       |
|---------|-------|
| Initial | Final |
| 989.63  |       |
| 990.29  |       |
| 993.26  |       |
| 994.02  |       |~~
~~|         |        |
|---------|--------|
| Initial | Final  |
| 990.93  | 994.12 |
| 995.39  | 994.54 |
| 993.32  | 996.95 |
| 989.67  | 993.51 |~~
~~|         |       |
|---------|-------|
| Initial | Final |
| 990.32  |       |
| 998.67  |       |
| 991.29  |       |
| 997.28  |       |~~
~~|         |        |
|---------|--------|
| Initial | Final  |
| 994.13  | 997.19 |
| 993.24  | 998.57 |
| 990.74  | 993.30 |
| 990.61  | 993.77 |~~
~~|           |         |       |
|-----------|---------|-------|
| Replicate | Initial | Final |
| a         | 995.50  |       |
| b         | 990.15  |       |
| c         | 997.26  |       |
| d         | 990.42  |       |
| e         |         |       |~~
~~|         |        |
|---------|--------|
| Initial | Final  |
| 991.17  | 994.60 |
| 995.38  | 998.34 |
| 991.43  | 994.20 |
| 993.50  | 994.65 |~~
~~|         |       |
|---------|-------|
| Initial | Final |
| 996.68  |       |
| 1001.32 |       |
| 984.84  |       |
| 995.95  |       |~~
~~|         |        |
|---------|--------|
| Initial | Final  |
| 990.42  | 994.12 |
| 995.73  | 997.84 |
| 989.60  | 991.94 |
| 990.63  | 991.44 |~~
~~|         |       |
|---------|-------|
| Initial | Final |
|         |       |
|         |       |
|         |       |
|         |       |~~
~~|         |       |
|---------|-------|
| Initial | Final |
|         |       |
|         |       |
|         |       |
|         |       |~~

Balance Calibration Check:

first pan weighed: Initial Final  
weight of first pan: 990.29 990.29  
first pan after all other pans weighed: 990.26 991.19

% difference < 5%:

Yes/No

Yes/No

$$\% \text{ difference} = \frac{(\text{initial weight} - \text{reweight})}{(\text{initial weight} + \text{reweight}) / 2} \times 100\%$$

Reviewed By:                     

Date Reviewed:                     

Test Validity Met:

Yes/No/NA

Results are Logical\*\*:

Yes/No

\*\* no negative numbers, consistent values across replicates

If "no" is circled for any parameter, notify Lab Supervisor/  
QA Group to determine appropriate action



## CETIS Analytical Report

Report Date: 12 Dec-18 16:18 (p 1 of 3)  
 Test Code/ID: SP1718-015 MHW / 10-5027-5756

| Ephemeroptera (Mayfly) 28-d Test |                 |            |                         | Nautilus Environmental Calgary |               |
|----------------------------------|-----------------|------------|-------------------------|--------------------------------|---------------|
| Analysis ID:                     | 01-5850-8212    | Endpoint:  | 28d Survival Rate       | CETIS Version:                 | CETISv1.9.4   |
| Analyzed:                        | 12 Dec-18 16:18 | Analysis:  | Linear Regression (GLM) | Status Level:                  | 1             |
| Batch ID:                        | 18-0905-7413    | Test Type: | Growth-Survival (7d)    | Analyst:                       | Madison Lehti |
| Start Date:                      | 03 Sep-18       | Protocol:  | Not Applicable          | Diluent:                       |               |
| Ending Date:                     | 01 Oct-18       | Species:   | Ephemeroptera           | Brine:                         |               |
| Test Length:                     | 28d 0h          | Taxon:     |                         | Source:                        | Age:          |
| Sample ID:                       | 09-7385-4884    | Code:      | SP1718-015 MHW          | Project:                       |               |
| Sample Date:                     | 17 Aug-18       | Material:  | chloride                | Source:                        | Equilibrium   |
| Receipt Date:                    | 17 Aug-18       | CAS (PC):  |                         | Station:                       | na            |
| Sample Age:                      | 17d 0h          | Client:    | Equilibrium             |                                |               |

| Linear Regression Options |                             |                   |        |           |        |          |          |
|---------------------------|-----------------------------|-------------------|--------|-----------|--------|----------|----------|
| Model Name                | Link Function               | Threshold Option  | Thresh | Optimized | Pooled | Het Corr | Weighted |
| Log-Gompertz              | $\eta = \log[-\log[1-\pi]]$ | Control Threshold | 0.125  | Yes       | No     | No       | Yes      |

| Regression Summary |       |       |       |       |       |        |        |          |         |                         |
|--------------------|-------|-------|-------|-------|-------|--------|--------|----------|---------|-------------------------|
| Iters              | LL    | AICc  | BIC   | Mu    | Sigma | Adj R2 | F Stat | Critical | P-Value | Decision( $\alpha$ :5%) |
| 15                 | -27.9 | 63.01 | 65.34 | 2.676 |       | 0.9528 | 3.954  | 3.16     | 0.0250  | Significant Lack of Fit |

| Point Estimates |       |         |         |
|-----------------|-------|---------|---------|
| Level           | mg/L  | 95% LCL | 95% UCL |
| LC5             | 71.97 | 18.48   | 133.6   |
| LC10            | 113.6 | 38.54   | 187.2   |
| LC15            | 149.6 | 59.89   | 229.7   |
| LC20            | 182.9 | 82.54   | 267.2   |
| LC25            | 214.9 | 106.6   | 302.1   |
| LC40            | 309.4 | 188.2   | 402.3   |
| LC50            | 375.5 | 252.3   | 472.8   |

| Regression Parameters |          |           |         |         |        |         |                         |
|-----------------------|----------|-----------|---------|---------|--------|---------|-------------------------|
| Parameter             | Estimate | Std Error | 95% LCL | 95% UCL | t Stat | P-Value | Decision( $\alpha$ :5%) |
| Threshold             | 0.1517   | 0.04839   | 0.05689 | 0.2466  | 3.135  | 0.0050  | Significant Parameter   |
| Slope                 | 3.629    | 0.7122    | 2.233   | 5.025   | 5.096  | 4.8E-05 | Significant Parameter   |
| Intercept             | -9.709   | 1.945     | -13.52  | -5.898  | -4.993 | 6.1E-05 | Significant Parameter   |

| ANOVA Table |             |             |    |        |          |                         |
|-------------|-------------|-------------|----|--------|----------|-------------------------|
| Source      | Sum Squares | Mean Square | DF | F Stat | P-Value  | Decision( $\alpha$ :5%) |
| Model       | 164.5       | 82.27       | 2  | 233.3  | <1.0E-37 | Significant             |
| Lack of Fit | 2.942       | 0.9807      | 3  | 3.954  | 0.0250   | Significant             |
| Pure Error  | 4.464       | 0.248       | 18 |        |          |                         |
| Residual    | 7.406       | 0.3527      | 21 |        |          |                         |

| Residual Analysis |                                  |           |          |         |                               |
|-------------------|----------------------------------|-----------|----------|---------|-------------------------------|
| Attribute         | Method                           | Test Stat | Critical | P-Value | Decision( $\alpha$ :5%)       |
| Goodness-of-Fit   | Pearson Chi-Sq GOF Test          | 7.406     | 32.67    | 0.9972  | Non-Significant Heterogeneity |
|                   | Likelihood Ratio GOF Test        | 7.593     | 32.67    | 0.9966  | Non-Significant Heterogeneity |
| Extreme Value     | Grubbs Extreme Value Test        | 1.93      | 2.802    | 1.0000  | No Outliers Detected          |
| Variances         | Mod Levene Equality of Variance  | 1.525     | 2.773    | 0.2317  | Equal Variances               |
| Distribution      | Shapiro-Wilk W Normality Test    | 0.9467    | 0.9169   | 0.2294  | Normal Distribution           |
|                   | Anderson-Darling A2 Normality Te | 0.4416    | 2.492    | 0.2936  | Normal Distribution           |

# CETIS Analytical Report

Report Date: 12 Dec-18 16:18 (p 2 of 3)  
 Test Code/ID: SP1718-015 MHW / 10-5027-5756

## Ephemeroptera (Mayfly) 28-d Test Nautilus Environmental Calgary

Analysis ID: 01-5850-8212      Endpoint: 28d Survival Rate      CETIS Version: CETISv1.9.4  
 Analyzed: 12 Dec-18 16:18      Analysis: Linear Regression (GLM)      Status Level: 1

| 7d Survival Rate Summary |      |       | Calculated Variate(A/B) |        |        |         |         |        |         |    |    |
|--------------------------|------|-------|-------------------------|--------|--------|---------|---------|--------|---------|----|----|
| Conc-mg/L                | Code | Count | Mean                    | Min    | Max    | Std Err | Std Dev | CV%    | %Effect | A  | B  |
| 2.25                     | N    | 4     | 0.8750                  | 0.8000 | 0.9000 | 0.0250  | 0.0500  | 5.71%  | 0.0%    | 35 | 40 |
| 78                       |      | 4     | 0.8000                  | 0.7000 | 0.9000 | 0.0408  | 0.0817  | 10.21% | 8.57%   | 32 | 40 |
| 154.33                   |      | 4     | 0.6250                  | 0.6000 | 0.7000 | 0.0250  | 0.0500  | 8.00%  | 28.57%  | 25 | 40 |
| 324.33                   |      | 4     | 0.5639                  | 0.5000 | 0.6000 | 0.0237  | 0.0475  | 8.42%  | 35.56%  | 22 | 39 |
| 640.33                   |      | 4     | 0.1750                  | 0.1000 | 0.3000 | 0.0479  | 0.0957  | 54.71% | 80.0%   | 7  | 40 |
| 1280                     |      | 4     | 0.0000                  | 0.0000 | 0.0000 | 0.0000  | 0.0000  |        | 100.0%  | 0  | 40 |

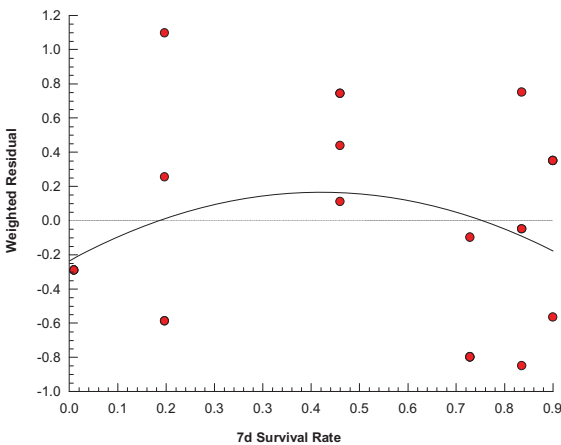
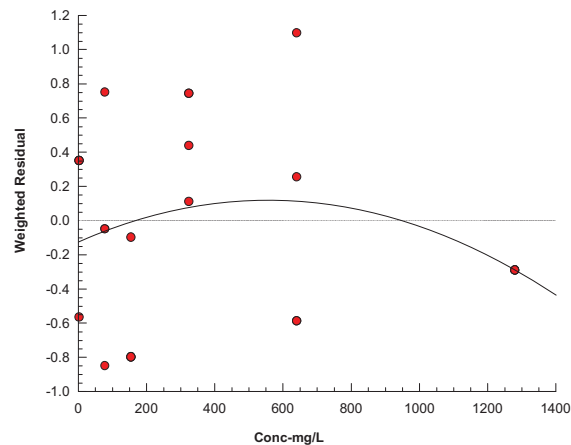
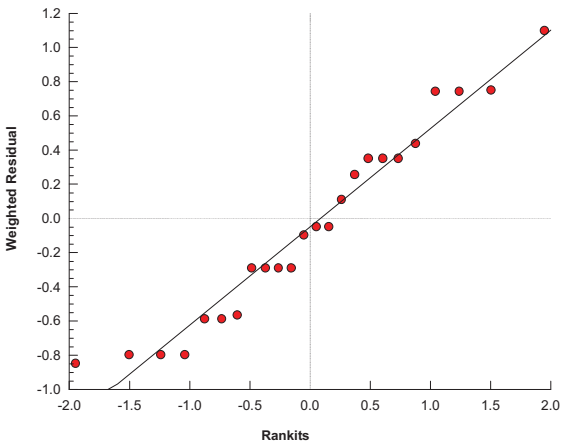
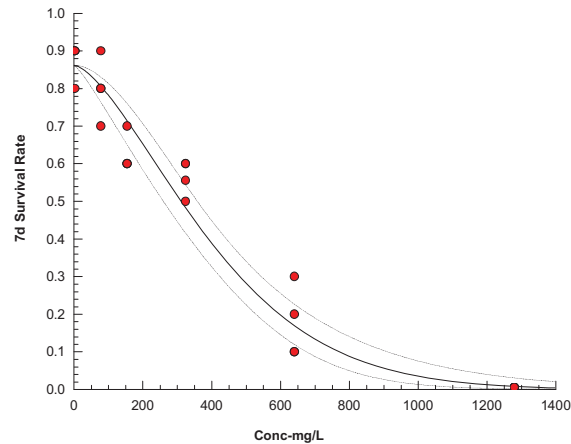
| 7d Survival Rate Detail |      |        |        |        |        |
|-------------------------|------|--------|--------|--------|--------|
| Conc-mg/L               | Code | Rep 1  | Rep 2  | Rep 3  | Rep 4  |
| 2.25                    | N    | 0.9000 | 0.9000 | 0.8000 | 0.9000 |
| 78                      |      | 0.8000 | 0.7000 | 0.9000 | 0.8000 |
| 154.33                  |      | 0.7000 | 0.6000 | 0.6000 | 0.6000 |
| 324.33                  |      | 0.6000 | 0.5556 | 0.6000 | 0.5000 |
| 640.33                  |      | 0.1000 | 0.2000 | 0.3000 | 0.1000 |
| 1280                    |      | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

| 7d Survival Rate Binomials |      |       |       |       |       |
|----------------------------|------|-------|-------|-------|-------|
| Conc-mg/L                  | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 |
| 2.25                       | N    | 9/10  | 9/10  | 8/10  | 9/10  |
| 78                         |      | 8/10  | 7/10  | 9/10  | 8/10  |
| 154.33                     |      | 7/10  | 6/10  | 6/10  | 6/10  |
| 324.33                     |      | 6/10  | 5/9   | 6/10  | 5/10  |
| 640.33                     |      | 1/10  | 2/10  | 3/10  | 1/10  |
| 1280                       |      | 0/10  | 0/10  | 0/10  | 0/10  |

Ephemeroptera (Mayfly) 28-d Test Nautilus Environmental Calgary

|                           |                                   |                            |
|---------------------------|-----------------------------------|----------------------------|
| Analysis ID: 01-5850-8212 | Endpoint: 28d Survival Rate       | CETIS Version: CETISv1.9.4 |
| Analyzed: 12 Dec-18 16:18 | Analysis: Linear Regression (GLM) | Status Level: 1            |

Graphics Log-Gompertz:  $\log[-\log[1-\pi]=\alpha+\beta\cdot\log[x]]$





## CETIS Analytical Report

Report Date: 12 Dec-18 16:16 (p 1 of 3)  
 Test Code/ID: SP1718-015 MHW / 10-5027-5756

| Ephemeroptera (Mayfly) 28-d Test |                 |            |                         | Nautilus Environmental Calgary |               |
|----------------------------------|-----------------|------------|-------------------------|--------------------------------|---------------|
| Analysis ID:                     | 19-1329-6787    | Endpoint:  | 28d Emergence Rate      | CETIS Version:                 | CETISv1.9.4   |
| Analyzed:                        | 12 Dec-18 16:16 | Analysis:  | Linear Regression (GLM) | Status Level:                  | 1             |
| Batch ID:                        | 18-0905-7413    | Test Type: | Growth-Survival (7d)    | Analyst:                       | Madison Lehti |
| Start Date:                      | 03 Sep-18       | Protocol:  | Not Applicable          | Diluent:                       |               |
| Ending Date:                     | 01 Oct-18       | Species:   | Ephemeroptera           | Brine:                         |               |
| Test Length:                     | 28d 0h          | Taxon:     |                         | Source:                        | Age:          |
| Sample ID:                       | 09-7385-4884    | Code:      | SP1718-015 MHW          | Project:                       |               |
| Sample Date:                     | 17 Aug-18       | Material:  | chloride                | Source:                        | Equilibrium   |
| Receipt Date:                    | 17 Aug-18       | CAS (PC):  |                         | Station:                       | na            |
| Sample Age:                      | 17d 0h          | Client:    | Equilibrium             |                                |               |

| Linear Regression Options |                             |                   |        |           |        |          |          |
|---------------------------|-----------------------------|-------------------|--------|-----------|--------|----------|----------|
| Model Name                | Link Function               | Threshold Option  | Thresh | Optimized | Pooled | Het Corr | Weighted |
| Log-Gompertz              | $\eta = \log[-\log[1-\pi]]$ | Control Threshold | 0.125  | Yes       | No     | No       | Yes      |

| Regression Summary |        |       |       |       |       |        |        |          |         |                         |
|--------------------|--------|-------|-------|-------|-------|--------|--------|----------|---------|-------------------------|
| Iters              | LL     | AICc  | BIC   | Mu    | Sigma | Adj R2 | F Stat | Critical | P-Value | Decision( $\alpha$ :5%) |
| 14                 | -28.49 | 64.18 | 66.52 | 2.658 |       | 0.946  | 3.702  | 3.16     | 0.0310  | Significant Lack of Fit |

| Point Estimates |       |         |         |
|-----------------|-------|---------|---------|
| Level           | mg/L  | 95% LCL | 95% UCL |
| LC5             | 58.08 | 14.11   | 112.7   |
| LC10            | 95.67 | 31      | 163.3   |
| LC15            | 129.2 | 49.7    | 204.6   |
| LC20            | 160.9 | 70.08   | 241.6   |
| LC25            | 191.9 | 92.15   | 276.5   |
| LC40            | 285.8 | 169.6   | 378.5   |
| LC50            | 353.1 | 232.3   | 451.5   |

| Regression Parameters |          |           |         |         |        |         |                         |
|-----------------------|----------|-----------|---------|---------|--------|---------|-------------------------|
| Parameter             | Estimate | Std Error | 95% LCL | 95% UCL | t Stat | P-Value | Decision( $\alpha$ :5%) |
| Threshold             | 0.1519   | 0.05028   | 0.05338 | 0.2505  | 3.022  | 0.0065  | Significant Parameter   |
| Slope                 | 3.322    | 0.6304    | 2.086   | 4.557   | 5.269  | 3.2E-05 | Significant Parameter   |
| Intercept             | -8.83    | 1.716     | -12.19  | -5.466  | -5.145 | 4.3E-05 | Significant Parameter   |

| ANOVA Table |             |             |    |        |          |                         |
|-------------|-------------|-------------|----|--------|----------|-------------------------|
| Source      | Sum Squares | Mean Square | DF | F Stat | P-Value  | Decision( $\alpha$ :5%) |
| Model       | 156.5       | 78.25       | 2  | 202.3  | <1.0E-37 | Significant             |
| Lack of Fit | 3.1         | 1.033       | 3  | 3.702  | 0.0310   | Significant             |
| Pure Error  | 5.024       | 0.2791      | 18 |        |          |                         |
| Residual    | 8.124       | 0.3868      | 21 |        |          |                         |

| Residual Analysis |                                  |           |          |         |                               |
|-------------------|----------------------------------|-----------|----------|---------|-------------------------------|
| Attribute         | Method                           | Test Stat | Critical | P-Value | Decision( $\alpha$ :5%)       |
| Goodness-of-Fit   | Pearson Chi-Sq GOF Test          | 8.124     | 32.67    | 0.9946  | Non-Significant Heterogeneity |
|                   | Likelihood Ratio GOF Test        | 8.271     | 32.67    | 0.9939  | Non-Significant Heterogeneity |
| Extreme Value     | Grubbs Extreme Value Test        | 2.154     | 2.802    | 0.5799  | No Outliers Detected          |
| Variances         | Mod Levene Equality of Variance  | 1.237     | 2.773    | 0.3327  | Equal Variances               |
| Distribution      | Shapiro-Wilk W Normality Test    | 0.9593    | 0.9169   | 0.4240  | Normal Distribution           |
|                   | Anderson-Darling A2 Normality Te | 0.5412    | 2.492    | 0.1685  | Normal Distribution           |

# CETIS Analytical Report

Report Date: 12 Dec-18 16:16 (p 2 of 3)  
 Test Code/ID: SP1718-015 MHW / 10-5027-5756

## Ephemeroptera (Mayfly) 28-d Test Nautilus Environmental Calgary

Analysis ID: 19-1329-6787      Endpoint: 28d Emergence Rate      CETIS Version: CETISv1.9.4  
 Analyzed: 12 Dec-18 16:16      Analysis: Linear Regression (GLM)      Status Level: 1

| 7d Survival Rate Summary |      |       | Calculated Variate(A/B) |        |        |         |         |        |         |    |    |
|--------------------------|------|-------|-------------------------|--------|--------|---------|---------|--------|---------|----|----|
| Conc-mg/L                | Code | Count | Mean                    | Min    | Max    | Std Err | Std Dev | CV%    | %Effect | A  | B  |
| 2.25                     | N    | 4     | 0.8750                  | 0.8000 | 0.9000 | 0.0250  | 0.0500  | 5.71%  | 0.0%    | 35 | 40 |
| 78                       |      | 4     | 0.7750                  | 0.7000 | 0.8000 | 0.0250  | 0.0500  | 6.45%  | 11.43%  | 31 | 40 |
| 154.33                   |      | 4     | 0.6000                  | 0.5000 | 0.7000 | 0.0408  | 0.0817  | 13.61% | 31.43%  | 24 | 40 |
| 324.33                   |      | 4     | 0.5389                  | 0.4000 | 0.6000 | 0.0475  | 0.0949  | 17.62% | 38.41%  | 21 | 39 |
| 640.33                   |      | 4     | 0.1750                  | 0.1000 | 0.3000 | 0.0479  | 0.0957  | 54.71% | 80.0%   | 7  | 40 |
| 1280                     |      | 4     | 0.0000                  | 0.0000 | 0.0000 | 0.0000  | 0.0000  |        | 100.0%  | 0  | 40 |

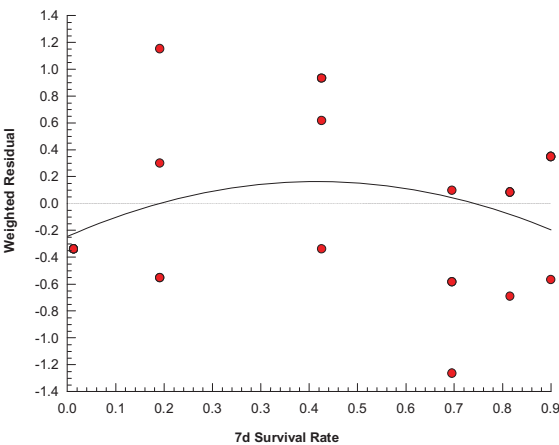
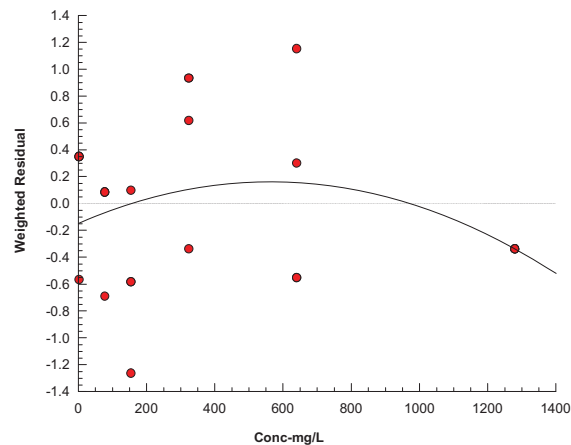
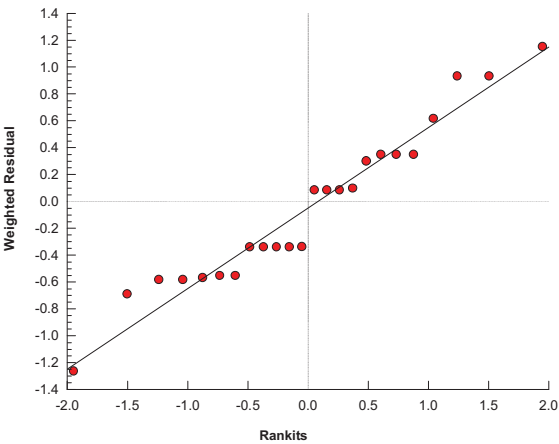
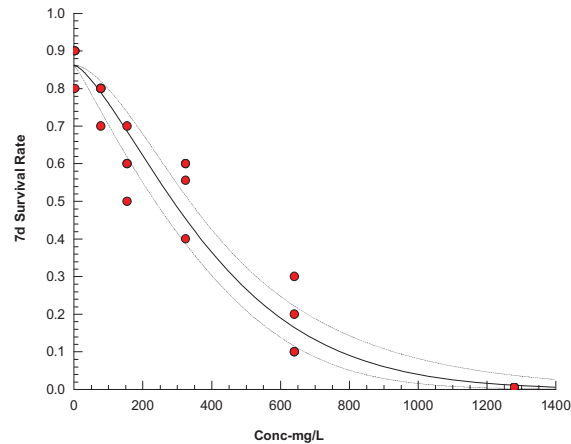
| 7d Survival Rate Detail |      |        |        |        |        |
|-------------------------|------|--------|--------|--------|--------|
| Conc-mg/L               | Code | Rep 1  | Rep 2  | Rep 3  | Rep 4  |
| 2.25                    | N    | 0.9000 | 0.9000 | 0.8000 | 0.9000 |
| 78                      |      | 0.8000 | 0.7000 | 0.8000 | 0.8000 |
| 154.33                  |      | 0.7000 | 0.5000 | 0.6000 | 0.6000 |
| 324.33                  |      | 0.6000 | 0.5556 | 0.6000 | 0.4000 |
| 640.33                  |      | 0.1000 | 0.2000 | 0.3000 | 0.1000 |
| 1280                    |      | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

| 7d Survival Rate Binomials |      |       |       |       |       |
|----------------------------|------|-------|-------|-------|-------|
| Conc-mg/L                  | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 |
| 2.25                       | N    | 9/10  | 9/10  | 8/10  | 9/10  |
| 78                         |      | 8/10  | 7/10  | 8/10  | 8/10  |
| 154.33                     |      | 7/10  | 5/10  | 6/10  | 6/10  |
| 324.33                     |      | 6/10  | 5/9   | 6/10  | 4/10  |
| 640.33                     |      | 1/10  | 2/10  | 3/10  | 1/10  |
| 1280                       |      | 0/10  | 0/10  | 0/10  | 0/10  |

|                                  |                 |           |                                |                            |
|----------------------------------|-----------------|-----------|--------------------------------|----------------------------|
| Ephemeroptera (Mayfly) 28-d Test |                 |           | Nautilus Environmental Calgary |                            |
| Analysis ID:                     | 19-1329-6787    | Endpoint: | 28d Emergence Rate             | CETIS Version: CETISv1.9.4 |
| Analyzed:                        | 12 Dec-18 16:16 | Analysis: | Linear Regression (GLM)        | Status Level: 1            |

Graphics

Log-Gompertz:  $\log[-\log[1-\pi]=\alpha+\beta\cdot\log[x]$



## CETIS Analytical Report

Report Date: 04 Dec-18 10:17 (p 1 of 2)  
 Test Code/ID: SP1718-015 MHW / 10-5027-5756

| Ephemeroptera (Mayfly) 28-d Test |                 |            |                              | Nautilus Environmental Calgary |               |
|----------------------------------|-----------------|------------|------------------------------|--------------------------------|---------------|
| Analysis ID:                     | 16-5179-8668    | Endpoint:  | Mean Dry Weight-mg           | CETIS Version:                 | CETISv1.9.4   |
| Analyzed:                        | 04 Dec-18 10:17 | Analysis:  | Linear Interpolation (ICPIN) | Status Level:                  | 1             |
| Batch ID:                        | 18-0905-7413    | Test Type: | Growth-Survival (7d)         | Analyst:                       | Madison Lehti |
| Start Date:                      | 03 Sep-18       | Protocol:  | Not Applicable               | Diluent:                       |               |
| Ending Date:                     | 01 Oct-18       | Species:   | Ephemeroptera                | Brine:                         |               |
| Test Length:                     | 28d 0h          | Taxon:     |                              | Source:                        | Age:          |
| Sample ID:                       | 09-7385-4884    | Code:      | SP1718-015 MHW               | Project:                       |               |
| Sample Date:                     | 17 Aug-18       | Material:  | chloride                     | Source:                        | Equilibrium   |
| Receipt Date:                    | 17 Aug-18       | CAS (PC):  |                              | Station:                       | na            |
| Sample Age:                      | 17d 0h          | Client:    | Equilibrium                  |                                |               |

## Linear Interpolation Options

| X Transform | Y Transform | Seed   | Resamples | Exp 95% CL | Method                  |
|-------------|-------------|--------|-----------|------------|-------------------------|
| Log(X+1)    | Linear      | 835729 | 200       | Yes        | Two-Point Interpolation |

## Residual Analysis

| Attribute     | Method                    | Test Stat | Critical | P-Value | Decision(α:5%)                    |
|---------------|---------------------------|-----------|----------|---------|-----------------------------------|
| Extreme Value | Grubbs Extreme Value Test | 2.633     | 2.708    | 0.0712  | No Outliers Detected              |
| Control Trend | Mann-Kendall Trend Test   | 2.633     |          | 0.7391  | Non-Significant Trend in Controls |

## Point Estimates

| Level | mg/L   | 95% LCL | 95% UCL |
|-------|--------|---------|---------|
| IC5   | >640.3 | n/a     | n/a     |
| IC10  | >640.3 | n/a     | n/a     |
| IC15  | >640.3 | n/a     | n/a     |
| IC20  | >640.3 | n/a     | n/a     |
| IC25  | >640.3 | n/a     | n/a     |
| IC40  | >640.3 | n/a     | n/a     |
| IC50  | >640.3 | n/a     | n/a     |

## Mean Dry Weight-mg Summary

|           |      |       | Calculated Variate |        |        |         |        |         | Isotonic Variate |         |
|-----------|------|-------|--------------------|--------|--------|---------|--------|---------|------------------|---------|
| Conc-mg/L | Code | Count | Mean               | Min    | Max    | Std Dev | CV%    | %Effect | Mean             | %Effect |
| 2.25      | N    | 4     | 0.4653             | 0.3478 | 0.5625 | 0.08862 | 19.04% | 0.0%    | 0.5624           | 0.0%    |
| 78        |      | 4     | 0.4845             | 0.3988 | 0.5929 | 0.08051 | 16.62% | -4.11%  | 0.5624           | 0.0%    |
| 154.33    |      | 4     | 0.4641             | 0.4267 | 0.5267 | 0.04489 | 9.67%  | 0.26%   | 0.5624           | 0.0%    |
| 324.33    |      | 4     | 0.572              | 0.4617 | 0.6625 | 0.08319 | 14.55% | -22.91% | 0.5624           | 0.0%    |
| 640.33    |      | 4     | 0.8262             | 0.7    | 1.055  | 0.1566  | 18.95% | -77.56% | 0.5624           | 0.0%    |

## Mean Dry Weight-mg Detail

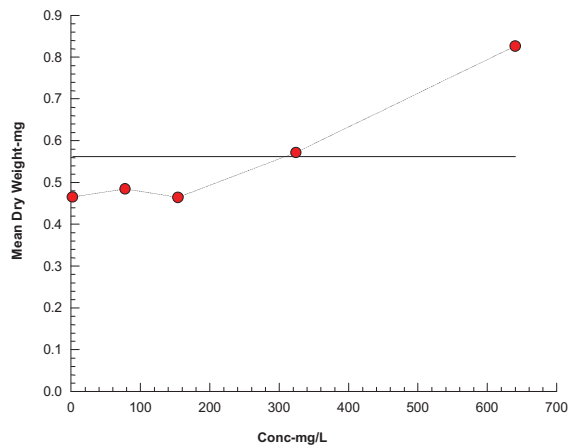
| Conc-mg/L | Code | Rep 1  | Rep 2  | Rep 3  | Rep 4  |
|-----------|------|--------|--------|--------|--------|
| 2.25      | N    | 0.3478 | 0.4822 | 0.5625 | 0.4689 |
| 78        |      | 0.3988 | 0.5929 | 0.4663 | 0.48   |
| 154.33    |      | 0.4371 | 0.466  | 0.4267 | 0.5267 |
| 324.33    |      | 0.5717 | 0.592  | 0.4617 | 0.6625 |
| 640.33    |      | 0.7    | 1.055  | 0.78   | 0.77   |

CETIS Analytical Report

Report Date: 04 Dec-18 10:17 (p 2 of 2)  
Test Code/ID: SP1718-015 MHW / 10-5027-5756

| Ephemeroptera (Mayfly) 28-d Test |                 | Nautilus Environmental Calgary |                              |
|----------------------------------|-----------------|--------------------------------|------------------------------|
| Analysis ID:                     | 16-5179-8668    | Endpoint:                      | Mean Dry Weight-mg           |
| Analized:                        | 04 Dec-18 10:17 | Analysis:                      | Linear Interpolation (ICPIN) |
|                                  |                 | CETIS Version:                 | CETISv1.9.4                  |
|                                  |                 | Status Level:                  | 1                            |

Graphics





## **APPENDIX C – Hard Water Toxicity Test Data**

---

Water Type: hard water (hw) Client: Equilibrium Sample Reference: SP1718-015

| Date       | Day | Initials | Chem Cart | Fed           | Daily Data Review |
|------------|-----|----------|-----------|---------------|-------------------|
| 2018/08/29 | 0   | WLS      | 3         | 1 slide 2ml   | HP                |
| 2018/08/30 | 1   | ST       | 3         | 0.5ml         | ML                |
| 2018/08/31 | 2   | ST       | 3         | -             | EP                |
| 2018/09/01 | 3   | ST       | 3         | 0.5ml         | SS                |
| 2018/09/02 | 4   | ML       | 3         | 0.5ml         | LC                |
| 2018/09/03 | 5   | ML       | 3         | 1 slide 2ml   | ICL               |
| 2018/09/04 | 6   | ML       | 3         | 1ml           | ML                |
| 2018/09/05 | 7   | ST/ML    | 3         | 1ml           | ML                |
| 2018/09/06 | 8   | ST       | 2         | 1ml slide     | ML                |
| 2018/09/07 | 9   | ST       | 2         | 1ml slide     | UF                |
| 2018/09/08 | 10  | ST       | 2         | 1ml           | UF                |
| 2018/09/09 | 11  | ML       | 3         | 2ml           | ICL               |
| 2018/09/10 | 12  | ML       | 2         | 1 slide       | ICL               |
| 2018/09/11 | 13  | ML/CB    | 2         | 1 slide       | ST                |
| 2018/09/12 | 14  | ML/ST    | 2         |               | SS                |
| 2018/09/13 | 15  | ST/CB    | 2         |               | FD                |
| 2018/09/14 | 16  | ST/CB    | 2         | 1.5ml 1 slide | EP                |
| 2018/09/15 | 17  | ST       | 2         |               | UF                |
| 2018/09/16 | 18  | CB       | 3         |               | FD                |
| 2018/09/17 | 19  | ST       | 3         |               | CB                |
| 2018/09/18 | 20  | ML/ST    | 3         |               | FD                |
| 2018/09/19 | 21  | ML/ST    | 2         |               | UF                |
| 2018/09/20 | 22  | ML/ST    | 3         |               | CB                |
| 2018/09/21 | 23  | ML/ST    | 2         |               | UF                |
| 2018/09/22 | 24  | ML       | 2         |               | ML                |
| 2018/09/23 | 25  | ML/ST    | 2         |               | CB                |
| 2018/09/24 | 26  | ST       | 2         |               | EP                |
| 2018/09/25 | 27  | ST/ML    | 2         |               | ML                |
| 2018/09/26 | 28  | ST/ML    | 2         |               | ML                |

2018/09/03 transferred to 1L jars

2018/09/11 put on slight aeration

2018/09/15 put on slight aeration

2018/09/18 aerated

Reviewed By: ML/ST Date Reviewed: 2018/09/22 - 2018/09/26

Water Type: hw Client: Equilibrium Sample Reference: SP1718-015

**Water Chemistries**

| conc. (mg/L Cl) | Control       | 75 | 150 | 300 | 600 | 1200 |
|-----------------|---------------|----|-----|-----|-----|------|
| day             | New Solutions |    |     |     |     |      |

pH  
(units)

|    |     |     |     |     |     |     |
|----|-----|-----|-----|-----|-----|-----|
| 0  | 8.0 | 8.1 | 8.1 | 8.1 | 8.1 | 8.1 |
| 5  | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 |
| 7  | 8.3 | 8.2 | 8.3 | 8.3 | 8.3 | X   |
| 9  | 8.5 | 8.5 | 8.4 | 8.4 | 8.3 |     |
| 12 | 8.5 | 8.6 | 8.5 | 8.5 | 8.5 |     |
| 14 | 8.5 | 8.5 | 8.5 | 8.5 | 8.4 |     |
| 16 | 8.3 | 8.4 | 8.4 | 8.4 | 8.3 |     |
| 19 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 |     |
| 21 | 8.5 | 8.4 | 8.4 | 8.4 | 8.4 |     |
| 23 | 8.4 | 8.5 | 8.4 | 8.4 | 8.3 |     |
| 26 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 |     |
|    |     |     |     |     |     |     |
|    |     |     |     |     |     |     |

EC  
(uS/cm)

|    |     |     |      |      |      |      |
|----|-----|-----|------|------|------|------|
| 0  | 517 | 782 | 976  | 1433 | 2310 | 4070 |
| 5  | 603 | 807 | 1037 | 1522 | 2504 | 4530 |
| 7  | 560 | 803 | 1025 | 1509 | 2490 | X    |
| 9  | 664 | 826 | 1027 | 1490 | 2440 |      |
| 12 | 574 | 853 | 1032 | 1524 | 2520 |      |
| 14 | 557 | 790 | 908  | 1478 | 2470 |      |
| 16 | 602 | 827 | 1016 | 1537 | 2540 |      |
| 19 | 679 | 933 | 1150 | 1785 | 2920 |      |
| 21 | 569 | 769 | 984  | 1416 | 2370 |      |
| 23 | 563 | 801 | 1001 | 1485 | 2330 |      |
| 26 | 610 | 797 | 1032 | 1465 | 2370 |      |
|    |     |     |      |      |      |      |
|    |     |     |      |      |      |      |

Reviewed By:

MC  
ST

Date Reviewed:

2011/10/22  
2018/11/02



Water Type

hw

Client:

Equilibrium

Sample Reference:

SP1718-015

**Water Chemistries**

| conc. (mg/L Cl) | Control       | 75 | 150 | 300 | 600 | 1200 |
|-----------------|---------------|----|-----|-----|-----|------|
| day             | New Solutions |    |     |     |     |      |

DO  
(mg/L)

|    |     |     |     |     |     |     |
|----|-----|-----|-----|-----|-----|-----|
| 0  | 8.0 | 7.7 | 7.7 | 7.8 | 7.8 | 7.8 |
| 5  | 7.8 | 7.8 | 7.8 | 7.7 | 7.8 | 7.7 |
| 7  | 8.0 | 7.8 | 8.0 | 7.7 | 7.6 | X   |
| 9  | 7.8 | 7.8 | 7.7 | 7.6 | 7.6 |     |
| 12 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 |     |
| 14 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 |     |
| 16 | 7.4 | 7.4 | 7.5 | 7.4 | 7.4 |     |
| 19 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 |     |
| 21 | 7.3 | 7.3 | 7.3 | 7.3 | 7.3 |     |
| 23 | 7.4 | 7.3 | 7.3 | 7.3 | 7.3 |     |
| 26 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 |     |
|    |     |     |     |     |     |     |
|    |     |     |     |     |     |     |

Temp  
(°C)

|    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|
| 0  | 23 | 23 | 23 | 23 | 23 | 23 |
| 5  | 23 | 23 | 23 | 23 | 23 | 23 |
| 7  | 23 | 23 | 23 | 23 | 23 | X  |
| 9  | 23 | 23 | 23 | 23 | 23 |    |
| 12 | 23 | 23 | 23 | 23 | 23 |    |
| 14 | 23 | 23 | 23 | 23 | 23 |    |
| 16 | 23 | 23 | 23 | 23 | 23 |    |
| 19 | 23 | 23 | 23 | 23 | 23 |    |
| 21 | 23 | 23 | 23 | 23 | 23 |    |
| 23 | 23 | 23 | 23 | 23 | 23 |    |
| 26 | 23 | 23 | 23 | 23 | 23 |    |
|    |    |    |    |    |    |    |
|    |    |    |    |    |    |    |

Reviewed By:

ML  
ST

Date Reviewed:

2018/10/22  
2018/11/12

hw

**Client:**

### Equilibrium

Sample Reference:

SP1718-015

|                               |               |    |     |     |     |      |
|-------------------------------|---------------|----|-----|-----|-----|------|
| conc. (mg/L Cl <sup>-</sup> ) | Control       | 75 | 150 | 300 | 600 | 1200 |
| day                           | Old Solutions |    |     |     |     |      |

pH  
(units)

|    |     |     |     |     |     |     |
|----|-----|-----|-----|-----|-----|-----|
| 5  | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 |
| 7  | 8.5 | 8.2 | 8.3 | 8.2 | 8.2 | X   |
| 9  | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 |     |
| 12 | 8.6 | 8.6 | 8.5 | 8.5 | 8.5 |     |
| 14 | 8.5 | 8.5 | 8.4 | 8.4 | 8.4 |     |
| 16 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 |     |
| 19 | 8.3 | 8.3 | 8.3 | 8.3 | 8.4 |     |
| 22 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 |     |
| 23 | 8.3 | 8.4 | 8.4 | 8.3 | 8.3 |     |
| 26 | 8.1 | 8.3 | 8.3 | 8.2 | 8.3 |     |
| 28 | 8.2 | 8.2 | 8.2 | 8.2 | 8.2 |     |

EC  
( $\mu\text{S}/\text{cm}$ )

|    |     |     |      |      |      |      |
|----|-----|-----|------|------|------|------|
| 5  | 601 | 776 | 980  | 1404 | 2300 | 3890 |
| 7  | 617 | 807 | 1044 | 1508 | 2510 | X    |
| 9  | 589 | 809 | 1018 | 1438 | 2450 |      |
| 12 | 610 | 819 | 1029 | 1512 | 2490 |      |
| 14 | 551 | 793 | 995  | 1446 | 2400 |      |
| 16 | 569 | 772 | 995  | 1512 | 2470 |      |
| 19 | 644 | 892 | 1110 | 1681 | 2770 |      |
| 21 | 722 | 964 | 1185 | 1777 | 2910 |      |
| 23 | 635 | 841 | 1045 | 1532 | 2420 |      |
| 26 | 624 | 824 | 1072 | 1526 | 2440 |      |
| 28 | 630 | 830 | 1050 | 1530 | 2450 |      |

\*See daily observations for DO and Temp of old solutions (taken daily)

Reviewed By:

Date Reviewed: 7/28/1922  
7/28/1922



Water Type

hw

Client:

Equilibrium

Sample Reference:

SP1718-015

## DAILY TEST OBSERVATIONS

### SURVIVAL

| conc. (mg/L Cl) | Control |   |   |   | 75 |   |   |   | 150 |   |   |   | 300 |   |   |   | 600 |   |   |   | 1200 |   |   |   |
|-----------------|---------|---|---|---|----|---|---|---|-----|---|---|---|-----|---|---|---|-----|---|---|---|------|---|---|---|
| Replicate day   | A       | B | C | D | A  | B | C | D | A   | B | C | D | A   | B | C | D | A   | B | C | D | A    | B | C | D |
| 1               | 10      |   |   |   | 10 |   |   |   | 10  |   |   |   | 10  |   |   |   | 10  |   |   |   | 10   |   |   |   |
| 2               | 10      |   |   |   | 10 |   |   |   | 10  |   |   |   | 10  |   |   |   | 10  |   |   |   | 10   |   |   |   |
| 3               | 10      |   |   |   | 10 |   |   |   | 10  |   |   |   | 10  |   |   |   | 10  |   |   |   | 10   |   |   |   |
| 4               | 10      |   |   |   | 10 |   |   |   | 10  |   |   |   | 10  |   |   |   | 10  |   |   |   | 10   |   |   |   |
| 5               | 10      |   |   |   | 10 |   |   |   | 10  |   |   |   | 10  |   |   |   | 10  |   |   |   | 10   |   |   |   |
| 6               | 10      |   |   |   | 10 |   |   |   | 10  |   |   |   | 10  |   |   |   | 10  |   |   |   | 10   |   |   |   |
| 7               | 10      |   |   |   | 10 |   |   |   | 10  |   |   |   | 10  |   |   |   | 10  |   |   |   | 10   |   |   |   |
| 8               | 10      |   |   |   | 10 |   |   |   | 10  |   |   |   | 10  |   |   |   | 10  |   |   |   | 10   |   |   |   |
| 9               | 10      |   |   |   | 10 |   |   |   | 10  |   |   |   | 10  |   |   |   | 10  |   |   |   | 10   |   |   |   |
| 10              | 10      |   |   |   | 10 |   |   |   | 10  |   |   |   | 10  |   |   |   | 10  |   |   |   | 10   |   |   |   |
| 11              | 10      |   |   |   | 10 |   |   |   | 10  |   |   |   | 10  |   |   |   | 10  |   |   |   | 10   |   |   |   |
| 12              | 10      |   |   |   | 10 |   |   |   | 10  |   |   |   | 10  |   |   |   | 10  |   |   |   | 10   |   |   |   |
| 13              | 10      |   |   |   | 10 |   |   |   | 10  |   |   |   | 10  |   |   |   | 10  |   |   |   | 10   |   |   |   |
| 14              | 10      |   |   |   | 10 |   |   |   | 10  |   |   |   | 10  |   |   |   | 10  |   |   |   | 10   |   |   |   |
| 15              | 10      |   |   |   | 10 |   |   |   | 10  |   |   |   | 10  |   |   |   | 10  |   |   |   | 10   |   |   |   |
| 16              | 10      |   |   |   | 10 |   |   |   | 10  |   |   |   | 10  |   |   |   | 10  |   |   |   | 10   |   |   |   |
| 17              | 10      |   |   |   | 10 |   |   |   | 10  |   |   |   | 10  |   |   |   | 10  |   |   |   | 10   |   |   |   |
| 18              | 10      |   |   |   | 10 |   |   |   | 10  |   |   |   | 10  |   |   |   | 10  |   |   |   | 10   |   |   |   |
| 19              | 10      |   |   |   | 10 |   |   |   | 10  |   |   |   | 10  |   |   |   | 10  |   |   |   | 10   |   |   |   |
| 20              | 10      |   |   |   | 10 |   |   |   | 10  |   |   |   | 10  |   |   |   | 10  |   |   |   | 10   |   |   |   |
| 21              | 10      |   |   |   | 10 |   |   |   | 10  |   |   |   | 10  |   |   |   | 10  |   |   |   | 10   |   |   |   |
| 22              | 10      |   |   |   | 10 |   |   |   | 10  |   |   |   | 10  |   |   |   | 10  |   |   |   | 10   |   |   |   |
| 23              | 10      |   |   |   | 10 |   |   |   | 10  |   |   |   | 10  |   |   |   | 10  |   |   |   | 10   |   |   |   |
| 24              | 10      |   |   |   | 10 |   |   |   | 10  |   |   |   | 10  |   |   |   | 10  |   |   |   | 10   |   |   |   |
| 25              | 10      |   |   |   | 10 |   |   |   | 10  |   |   |   | 10  |   |   |   | 10  |   |   |   | 10   |   |   |   |
| 26              | 10      |   |   |   | 10 |   |   |   | 10  |   |   |   | 10  |   |   |   | 10  |   |   |   | 10   |   |   |   |
| 27              | 10      |   |   |   | 10 |   |   |   | 10  |   |   |   | 10  |   |   |   | 10  |   |   |   | 10   |   |   |   |
| 28              | 10      |   |   |   | 10 |   |   |   | 10  |   |   |   | 10  |   |   |   | 10  |   |   |   | 10   |   |   |   |

day 14  
~~day 14~~  
 very  
 under-  
 developed

Reviewed By:

1008 - founder shed

Date Reviewed:

2018/02/22 - 2018/02/22

day 23-150C →  
 10 fly, escaped.  
 day 27  
 day 26 300A-1 failed  
 Nautilus Environmental (Calgary)  
 Subscript = H moved to  
 emergence jar



## DAILY TEST OBSERVATIONS

Life Cycle Stage

| conc. (mg/L Cl) | Control |   |   |   | 75 |   |   |   | 150 |   |   |   | 300 |   |   |   | 600 |   |   |   | 1200 |   |   |   |
|-----------------|---------|---|---|---|----|---|---|---|-----|---|---|---|-----|---|---|---|-----|---|---|---|------|---|---|---|
|                 | A       | B | C | D | A  | B | C | D | A   | B | C | D | A   | B | C | D | A   | B | C | D | A    | B | C | D |
| Replicate day   |         |   |   |   |    |   |   |   |     |   |   |   |     |   |   |   |     |   |   |   |      |   |   |   |
| 1               | N       | N | N | N | N  | N | N | N | N   | N | N | N | N   | N | N | N | N   | N | N | N | N    | N | N | N |
| 2               | N       | N | N | N | N  | N | N | N | N   | N | N | N | N   | N | N | N | N   | N | N | N | N    | N | N | N |
| 3               | N       | N | N | N | N  | N | N | N | N   | N | N | N | N   | N | N | N | N   | N | N | N | N    | N | N | N |
| 4               | N       | N | N | N | N  | N | N | N | N   | N | N | N | N   | N | N | N | N   | N | N | N | N    | N | N | N |
| 5               | N       | N | N | N | N  | N | N | N | N   | N | N | N | N   | N | N | N | N   | N | N | N | N    | N | N | N |
| 6               | N       | N | N | N | N  | N | N | N | N   | N | N | N | N   | N | N | N | N   | N | N | N | N    | N | N | N |
| 7               | N       | N | N | N | N  | N | N | N | N   | N | N | N | N   | N | N | N | N   | N | N | N | N    | N | N | N |
| 8               | N       | N | N | N | N  | N | N | N | N   | N | N | N | N   | N | N | N | N   | N | N | N | N    | N | N | N |
| 9               | N       | N | N | N | N  | N | N | N | N   | N | N | N | N   | N | N | N | N   | N | N | N | N    | N | N | N |
| 10              | N       | N | N | N | N  | N | N | N | N   | N | N | N | N   | N | N | N | N   | N | N | N | N    | N | N | N |
| 11              | N       | N | N | N | N  | N | N | N | N   | N | N | N | N   | N | N | N | N   | N | N | N | N    | N | N | N |
| 12              | N       | N | N | N | N  | N | N | N | N   | N | N | N | N   | N | N | N | N   | N | N | N | N    | N | N | N |
| 13              | N       | N | N | N | N  | N | N | N | N   | N | N | N | N   | N | N | N | N   | N | N | N | N    | N | N | N |
| 14              | N       | N | N | N | N  | N | N | N | N   | N | N | N | N   | N | N | N | N   | N | N | N | N    | N | N | N |
| 15              | N       | N | N | N | N  | N | N | N | N   | N | N | N | N   | N | N | N | N   | N | N | N | N    | N | N | N |
| 16              | N       | N | N | N | N  | N | N | N | N   | N | N | N | N   | N | N | N | N   | N | N | N | N    | N | N | N |
| 17              | N       | N | N | N | N  | N | N | N | N   | N | N | N | N   | N | N | N | N   | N | N | N | N    | N | N | N |
| 18              | N       | N | N | N | N  | N | N | N | N   | N | N | N | N   | N | N | N | N   | N | N | N | N    | N | N | N |
| 19              | N       | N | N | N | N  | N | N | N | N   | N | N | N | N   | N | N | N | N   | N | N | N | N    | N | N | N |
| 20              | N       | N | N | N | N  | N | N | N | N   | N | N | N | N   | N | N | N | N   | N | N | N | N    | N | N | N |
| 21              | N       | N | N | N | N  | N | N | N | N   | N | N | N | N   | N | N | N | N   | N | N | N | N    | N | N | N |
| 22              | N       | N | N | N | N  | N | N | N | N   | N | N | N | N   | N | N | N | N   | N | N | N | N    | N | N | N |
| 23              | N       | N | N | N | N  | N | N | N | N   | N | N | N | N   | N | N | N | N   | N | N | N | N    | N | N | N |
| 24              | N       | N | N | N | N  | N | N | N | N   | N | N | N | N   | N | N | N | N   | N | N | N | N    | N | N | N |
| 25              | N       | N | N | N | N  | N | N | N | N   | N | N | N | N   | N | N | N | N   | N | N | N | N    | N | N | N |
| 26              | N       | N | N | N | N  | N | N | N | N   | N | N | N | N   | N | N | N | N   | N | N | N | N    | N | N | N |
| 27              | N       | N | N | N | N  | N | N | N | N   | N | N | N | N   | N | N | N | N   | N | N | N | N    | N | N | N |
| 28              | N       | N | N | N | N  | N | N | N | N   | N | N | N | N   | N | N | N | N   | N | N | N | N    | N | N | N |

N = Nymph  
PE = Pre-Emergent  
\* put in brackets the number of organisms in each stage (ie. 10M, or 5N, 1PE)

Reviewed By: NCS

Date Reviewed: 2018/08/03

2018/10/23 - 75A - Dead PE

Day 26 150 A - one died during black wing

Nautilus Environmental (Calgary)

2018/10/23 - 75A - Dead PE

2018/10/23 - 75A - Dead PE

2018/10/23 - 75A - Dead PE



Water Type hwy

Client:

Equilibrium

Sample Reference:

SP1718-015

**DAILY TEST OBSERVATIONS**

DO (%) 80 - 100% saturation

| conc. (mg/L Cl) | Control |     |     |     | 75  |     |     |     | 150 |     |     |     | 300 |     |     |     | 600 |     |     |     | 1200 |     |     |     |
|-----------------|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|-----|-----|-----|
|                 | A       | B   | C   | D   | A   | B   | C   | D   | A   | B   | C   | D   | A   | B   | C   | D   | A   | B   | C   | D   | A    | B   | C   | D   |
| 1               | 8.7     | 8.5 | 8.5 | 8.6 | 8.5 | 8.5 | 8.6 | 8.6 | 8.7 | 8.7 | 8.7 | 8.7 | 8.7 | 8.7 | 8.7 | 8.7 | 8.8 | 8.8 | 8.8 | 8.8 | 8.7  | 8.8 | 8.8 | 8.8 |
| 2               | 9.3     | 9.1 | 8.7 | 8.6 | 8.6 | 8.6 | 8.6 | 8.6 | 8.7 | 8.7 | 8.7 | 8.7 | 8.7 | 8.7 | 8.7 | 8.7 | 8.6 | 8.6 | 8.7 | 8.7 | 8.5  | 8.5 | 8.7 | 8.7 |
| 3               | 7.9     | 7.9 | 7.9 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.4 | 8.4 | 8.4 | 8.4 | 8.0 | 8.5 | 8.5 | 8.5 | 8.0 | 8.4 | 8.7 | 8.7 | 8.6  | 8.6 | 8.7 | 8.7 |
| 4               | 8.0     | 8.0 | 8.0 | 8.1 | 8.1 | 8.1 | 8.1 | 8.1 | 8.2 | 8.2 | 8.2 | 8.2 | 8.3 | 8.3 | 8.3 | 8.3 | 8.2 | 8.2 | 8.2 | 8.2 | 8.0  | 8.1 | 8.1 | 8.2 |
| 5               | 8.0     | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0  | 8.0 | 8.0 | 8.0 |
| 6               | 8.0     | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0  | 8.0 | 8.0 | 8.0 |
| 7               | 8.4     | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4  | 8.4 | 8.4 | 8.4 |
| 8               | 7.4     | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4  | 7.4 | 7.4 | 7.4 |
| 9               | 7.4     | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4  | 7.4 | 7.4 | 7.4 |
| 10              | 7.4     | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4  | 7.4 | 7.4 | 7.4 |
| 11              | 7.4     | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4  | 7.4 | 7.4 | 7.4 |
| 12              | 7.4     | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4  | 7.4 | 7.4 | 7.4 |
| 13              | 7.4     | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4  | 7.4 | 7.4 | 7.4 |
| 14              | 7.4     | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4  | 7.4 | 7.4 | 7.4 |
| 15              | 7.4     | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4  | 7.4 | 7.4 | 7.4 |
| 16              | 7.4     | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4  | 7.4 | 7.4 | 7.4 |
| 17              | 6.8     | 6.9 | 7.0 | 6.8 | 6.8 | 6.8 | 6.8 | 6.8 | 6.8 | 6.8 | 6.8 | 6.8 | 6.8 | 6.8 | 6.8 | 6.8 | 6.8 | 6.8 | 6.8 | 6.8 | 6.8  | 6.8 | 6.8 | 6.8 |
| 18              | 7.2     | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2  | 7.2 | 7.2 | 7.2 |
| 19              | 7.4     | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4  | 7.4 | 7.4 | 7.4 |
| 20              | 6.2     | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2  | 6.2 | 6.2 | 6.2 |
| 21              | 6.2     | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2  | 6.2 | 6.2 | 6.2 |
| 22              | 6.2     | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2  | 6.2 | 6.2 | 6.2 |
| 23              | 6.2     | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2  | 6.2 | 6.2 | 6.2 |
| 24              | 6.2     | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2  | 6.2 | 6.2 | 6.2 |
| 25              | 6.2     | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2  | 6.2 | 6.2 | 6.2 |
| 26              | 6.2     | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2  | 6.2 | 6.2 | 6.2 |
| 27              | 6.2     | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2  | 6.2 | 6.2 | 6.2 |
| 28              | 6.2     | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2  | 6.2 | 6.2 | 6.2 |

Reviewed By:

Date Reviewed:

2018/10/22

2018/11/02



Water Type

Client WU

Equilibrium

Sample Reference: SP1718-015

## DAILY TEST OBSERVATIONS

Temperature (°C) - 24 +/- 1

| conc. (mg/L Cl) | Control |    |    |    | 75 |    |    |    | 150 |    |    |    | 300 |    |    |    | 600 |    |    |    | 1200 |    |    |    |
|-----------------|---------|----|----|----|----|----|----|----|-----|----|----|----|-----|----|----|----|-----|----|----|----|------|----|----|----|
|                 | A       | B  | C  | D  | A  | B  | C  | D  | A   | B  | C  | D  | A   | B  | C  | D  | A   | B  | C  | D  | A    | B  | C  | D  |
| 1               | 23      |    |    |    | 23 | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23   | 23 | 23 | 23 |
| 2               | 23      | 23 | 23 |    | 23 | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23  | 23 | 23 | 23 | 23   | 23 | 23 | 23 |
| 3               | 23      |    |    |    | 23 |    |    |    | 23  |    |    |    | 23  |    |    |    | 23  |    |    |    | 23   |    |    |    |
| 4               | 23      |    |    |    | 23 |    |    |    | 23  |    |    |    | 23  |    |    |    | 23  |    |    |    | 23   |    |    |    |
| 5               | 23      |    |    |    | 23 |    |    |    | 23  |    |    |    | 23  |    |    |    | 23  |    |    |    | 23   |    |    |    |
| 6               | 23      |    |    |    | 23 |    |    |    | 23  |    |    |    | 23  |    |    |    | 23  |    |    |    | 23   |    |    |    |
| 7               | 23      |    |    |    | 23 |    |    |    | 23  |    |    |    | 23  |    |    |    | 23  |    |    |    | 23   |    |    |    |
| 8               | 23      |    |    |    | 23 |    |    |    | 23  |    |    |    | 23  |    |    |    | 23  |    |    |    | 23   |    |    |    |
| 9               | 23      |    |    |    | 23 |    |    |    | 23  |    |    |    | 23  |    |    |    | 23  |    |    |    | 23   |    |    |    |
| 10              | 23      |    |    |    | 23 |    |    |    | 23  |    |    |    | 23  |    |    |    | 23  |    |    |    | 23   |    |    |    |
| 11              | 23      |    |    |    | 23 |    |    |    | 23  |    |    |    | 23  |    |    |    | 23  |    |    |    | 23   |    |    |    |
| 12              | 23      |    |    |    | 23 |    |    |    | 23  |    |    |    | 23  |    |    |    | 23  |    |    |    | 23   |    |    |    |
| 13              | 24      | 24 | 24 | 25 | 24 |    |    |    | 24  |    |    |    | 24  |    |    |    | 24  |    |    |    | 24   |    |    |    |
| 14              | 23      |    |    |    | 23 |    |    |    | 23  |    |    |    | 23  |    |    |    | 23  |    |    |    | 23   |    |    |    |
| 15              | 23      |    |    |    | 23 |    |    |    | 23  |    |    |    | 23  |    |    |    | 23  |    |    |    | 23   |    |    |    |
| 16              | 23      |    |    |    | 24 |    |    |    | 24  |    |    |    | 24  |    |    |    | 24  |    |    |    | 24   |    |    |    |
| 17              | 23      |    |    |    | 23 |    |    |    | 23  |    |    |    | 23  |    |    |    | 23  |    |    |    | 23   |    |    |    |
| 18              | 23      |    |    |    | 23 |    |    |    | 23  |    |    |    | 23  |    |    |    | 23  |    |    |    | 23   |    |    |    |
| 19              | 24      |    |    |    | 24 |    |    |    | 24  |    |    |    | 24  |    |    |    | 24  |    |    |    | 24   |    |    |    |
| 20              | 24      |    |    |    | 24 |    |    |    | 24  |    |    |    | 24  |    |    |    | 24  |    |    |    | 24   |    |    |    |
| 21              | 23      |    |    |    | 23 |    |    |    | 23  |    |    |    | 23  |    |    |    | 23  |    |    |    | 23   |    |    |    |
| 22              | 24      |    |    |    | 24 |    |    |    | 24  |    |    |    | 24  |    |    |    | 24  |    |    |    | 24   |    |    |    |
| 23              | 23      |    |    |    | 23 |    |    |    | 23  |    |    |    | 23  |    |    |    | 23  |    |    |    | 23   |    |    |    |
| 24              | 24      |    |    |    | 24 |    |    |    | 24  |    |    |    | 24  |    |    |    | 24  |    |    |    | 24   |    |    |    |
| 25              | 23      |    |    |    | 23 |    |    |    | 23  |    |    |    | 23  |    |    |    | 23  |    |    |    | 23   |    |    |    |
| 26              | 23      |    |    |    | 23 |    |    |    | 23  |    |    |    | 23  |    |    |    | 23  |    |    |    | 23   |    |    |    |
| 27              | 24      |    |    |    | 24 |    |    |    | 24  |    |    |    | 24  |    |    |    | 24  |    |    |    | 24   |    |    |    |
| 28              | 23      |    |    |    | 23 |    |    |    | 23  |    |    |    | 23  |    |    |    | 23  |    |    |    | 23   |    |    |    |

Reviewed By:

WU

Date Reviewed:

2018/08/22  
2018/11/08



we  
~~comment~~ comment summary

Client: \_\_\_\_\_  
Client #: \_\_\_\_\_

Sample #: HW  
Test #: \_\_\_\_\_

Date: \_\_\_\_\_  
Initials: \_\_\_\_\_

Day 5 - transferred to 11 jars  
Day 14 - 700 very underdeveloped  
Day 19 - 150B → crushed blue sides, killed by tech +  
Day 23 - 150C - fly escaped! + include in survival, net weight, emergence  
Day 26 - 300A → killed by tech + (out of 9)  
- 100A → 1 died emergency  
- 150B → 1 died in PE stage (from day 24, had not emerged by 25)  
- 75C → 1 died in PE stage  
- 150A → 1 died in PE stage  
Day 25 - 75A → died PE



Concentration:

HW-CTZ

Day:

22

Initials:

✓

Date:

—

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 9                   | 0              | /                          | /                           | /                     | 9                       | 9              |
| B     | 8                   | 1              | /                          | /                           | /                     | 8                       | 8              |
| C     | 8                   | 1              | /                          | /                           | /                     | 8                       | 8              |
| D     | 8                   | 1              | /                          | /                           | /                     | 8                       | 8              |

Day:

23

Initials:

—

Date:

—

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 8                   | 1              | 1                          | 0                           | 0                     | 7                       | 8              |
| B     | 8                   | 1              | 1                          | 1                           | 1                     | 7                       | 8              |
| C     | 8                   | 1              | 1                          | 1                           | 1                     | 7                       | 8              |
| D     | 8                   | 1              | 1                          | 1                           | 1                     | 7                       | 8              |

Day:

24

Initials:

—

Date:

—

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 7                   | 2              | 2                          | 1                           | 1                     | 5                       | 8              |
| B     | 7                   | 2              | 2                          | 1                           | 1                     | 5                       | 8              |
| C     | 7                   | 2              | 2                          | 1                           | 1                     | 5                       | 8              |
| D     | 7                   | 2              | 2                          | 1                           | 1                     | 5                       | 8              |

Day:

25

Initials:

—

Date:

—

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 5                   | 2              | 2                          | 2                           | 3                     | 3                       | 8              |
| B     | 5                   | 2              | 2                          | 2                           | 3                     | 3                       | 8              |
| C     | 5                   | 2              | 2                          | 2                           | 3                     | 3                       | 8              |
| D     | 5                   | 2              | 2                          | 2                           | 3                     | 3                       | 8              |

Day:

26

Initials:

—

Date:

—

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 3                   | 0              | 0                          | 5                           | 4                     | 3                       | 7              |
| B     | 4                   | 0              | 0                          | 5                           | 4                     | 0                       | 8              |
| C     | 3                   | 3              | 3                          | 1                           | 5                     | 0                       | 8              |
| D     | 4                   | 3              | 3                          | 2                           | 4                     | 1                       | 8              |

Concentration:

HW-CIL

Day:

27

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 3                   | 0              | 0                          | 0                           | 4                     | 3                       | 7              |
| B     | 1                   | 1              | 1                          | 4                           | 8                     | 1                       | 8              |
| C     | 1                   | 1              | 1                          | 3                           | 7                     | 1                       | 8              |
| D     | 1                   | 0              | 0                          | 3                           | 4                     | 1                       | 8              |

Day:

28

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 3                   | 3              | 3                          | 0                           | 4                     | 0                       | 7              |
| B     | 1                   | 1              | 1                          | 1                           | 8                     | 1                       | 8              |
| C     | 1                   | 1              | 1                          | 1                           | 8                     | 1                       | 8              |
| D     | 1                   | 1              | 1                          | 0                           | 4                     | 0                       | 8              |

Day:

29

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | /                   | /              | /                          | 3                           | 7                     | /                       | 7              |
| B     | /                   | /              | /                          | 1                           | 8                     | /                       | 8              |
| C     | /                   | /              | /                          | 1                           | 8                     | /                       | 8              |
| D     | /                   | /              | /                          | 1                           | 8                     | /                       | 8              |

Day:

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     |                     |                |                            |                             |                       |                         |                |

Day:

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     |                     |                |                            |                             |                       |                         |                |



Concentration:

Hw-75

Day:

22

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 8                   | 0              | /                          | /                           | 0                     | 8                       | 8              |
| B     | 9                   | ↓              | /                          | /                           | ↓                     | 9                       | 9              |
| C     | 7                   | ↓              | /                          | /                           | ↓                     | 7                       | 7              |
| D     | 9                   | ↓              | /                          | /                           | ↓                     | 9                       | 9              |

Day:

23

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 8                   | 1              | 1                          | /                           | 0                     | 8                       | 8              |
| B     | 9                   | 0              | 0                          | /                           | ↓                     | 9                       | 9              |
| C     | 7                   | 0              | 0                          | /                           | ↓                     | 7                       | 7              |
| D     | 9                   | 0              | 0                          | /                           | ↓                     | 9                       | 9              |

Day:

24

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 7                   | 1              | 1                          | 1                           | 1                     | 6                       | 8              |
| B     | 9                   | 0              | 0                          | 0                           | 0                     | 9                       | 9              |
| C     | 7                   | 3              | 3                          | 0                           | 0                     | 9                       | 7              |
| D     | 9                   | 1              | 1                          | 0                           | 0                     | 8                       | 9              |

Day:

25

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 6                   | 2              | 2                          | 0                           | 1                     | 4                       | 7              |
| B     | 9                   | 0              | 0                          | 0                           | 0                     | 9                       | 9              |
| C     | 4                   | 2              | 2                          | 3                           | 3                     | 2                       | 7              |
| D     | 8                   | 0              | 0                          | 1                           | 1                     | 8                       | 9              |

Day:

26

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 4                   | 1              | 1                          | 2                           | 3                     | 3                       | 7              |
| B     | 9                   | 0              | 0                          | 0                           | 0                     | 9                       | 9              |
| C     | 7                   | 1              | 1                          | 5                           | 4                     | 1                       | 6              |
| D     | 7                   | 1              | 1                          | 0                           | 1                     | 6                       | 8              |

Concentration:

HW-75

Day:

27

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 3                   | 3              | 3                          | 1                           | 4                     | 0                       | 7              |
| B     | 9                   | 4              | 3                          | 0                           | 0                     | 5                       | 9              |
| C     | 1                   | 0              | 0                          | 1                           | 5                     | 1                       | 6              |
| D     | 6                   | 2              | 2                          | 1                           | 2                     | 4                       | 8              |

Day:

28

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | —                   | —              | —                          | 3                           | 7                     | —                       | 7              |
| B     | 5                   | 1              | 1                          | 4                           | 4                     | 4                       | 9              |
| C     | 1                   | 0              | 0                          | 0                           | 5                     | 1                       | 6              |
| D     | 4                   | 2              | 2                          | 2                           | 4                     | 2                       | 8              |

Day:

29

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | /                   | /              | /                          | 7                           | 7                     | /                       | 7              |
| B     | /                   | /              | /                          | 5                           | 5                     | /                       | 9 (4 nymph)    |
| C     | /                   | /              | /                          | 0                           | 5                     | /                       | 6 (1 nymph)    |
| D     | /                   | /              | /                          | 2                           | 6                     | /                       | 8 (2 nymph)    |

Day:

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     |                     |                |                            |                             |                       |                         |                |

Day:

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     |                     |                |                            |                             |                       |                         |                |



Concentration:

HW-150

Day:

22

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 9                   | 0              | 0                          | 0                           | 0                     | 9                       | 9              |
| B     | 8                   | 0              | 0                          | 0                           | 0                     | 8                       | 8              |
| C     | 5                   | 0              | 0                          | 0                           | 0                     | 5                       | 5              |
| D     | 5                   | 0              | 0                          | 0                           | 0                     | 5                       | 5              |

Day:

23

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 9                   | 0              | 0                          | 0                           | 0                     | 9                       | 9              |
| B     | 8                   | 0              | 0                          | 0                           | 0                     | 8                       | 8              |
| C     | 6                   | 1              | 1                          | 0                           | 0                     | 5                       | 6              |
| D     | 5                   | 2              | 2                          | 0                           | 0                     | 3                       | 5              |

4 fly escaped  
 (alt of 9  
 for emergence  
 + weight)

Day:

24

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 9                   | 0              | 0                          | 0                           | 0                     | 9                       | 9              |
| B     | 8                   | 0              | 0                          | 0                           | 0                     | 8                       | 8              |
| C     | 5                   | 0              | 0                          | 1                           | 1                     | 4                       | 6              |
| D     | 3                   | 0              | 0                          | 2                           | 2                     | 1                       | 5              |

Day:

25

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 9                   | 2              | 2                          | 0                           | 0                     | 7                       | 9              |
| B     | 6                   | 0              | 0                          | 0                           | 0                     | 6                       | 6              |
| C     | 5                   | 2              | 2                          | 1                           | 1                     | 3                       | 6              |
| D     | 3                   | 1              | 1                          | 1                           | 2                     | 2                       | 5              |

Day:

26

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 7                   | 0              | 0                          | 1                           | 1                     | 6                       | 8              |
| B     | 6                   | 0              | 0                          | 0                           | 0                     | 6                       | 6              |
| C     | 3                   | 0              | 0                          | 2                           | 2                     | 1                       | 6              |
| D     | 2                   | 1              | 1                          | 1                           | 3                     | 1                       | 5              |



Concentration:

HW 750

Day:

27

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 6                   | 2              | 2                          | 1                           | 2                     | 4                       | 8              |
| B     | 6                   | 0              | 6                          | 0                           | 0                     | 6                       | 6              |
| C     | 3                   | 2              | 2                          | 0                           | 3                     | 0                       | 6              |
| D     | 1                   | 1              | 1                          | 1                           | 4                     | 0                       | 5              |

Day:

28

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 4                   | 0              | 0                          | 2                           | 4                     | 4                       | 8              |
| B     | 6                   | 2              | 2                          | 0                           | 0                     | 4                       | 6              |
| C     | 1                   | 1              | 1                          | 2                           | 3                     | 0                       | 6              |
| D     | 1                   | 1              | 1                          | 1                           | 5                     | 0                       | 5              |

Day:

29

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | /                   | /              | /                          | 0                           | 4                     | /                       | 8 (4 nymph)    |
| B     | /                   | /              | /                          | 2                           | 2                     | /                       | 6 (4 nymph)    |
| C     | /                   | /              | /                          | 1                           | 6                     | /                       | 6              |
| D     | /                   | /              | /                          | 1                           | 5                     | /                       | 5              |

Day:

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     |                     |                |                            |                             |                       |                         |                |

Day:

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     |                     |                |                            |                             |                       |                         |                |

Concentration:

HW-300

Day:

22

Initials:

✓

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 10                  | 0              | 0                          | /                           | 0                     | 10                      | 10             |
| B     | 6                   | 0              | 0                          | /                           | 0                     | 6                       | 6              |
| C     | 6                   | 0              | 0                          | /                           | 0                     | 6                       | 6              |
| D     | 7                   | 0              | 0                          | /                           | 0                     | 7                       | 7              |

Day:

23

Initials:

✓

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 10                  | 0              | 0                          | 0                           | 0                     | 10                      | 10             |
| B     | 6                   | 0              | 0                          | 0                           | 0                     | 6                       | 6              |
| C     | 6                   | 0              | 0                          | 0                           | 0                     | 6                       | 6              |
| D     | 6                   | 1              | 1                          | 0                           | 0                     | 5                       | 6              |

Day:

24

Initials:

✓

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 10                  | 0              | 0                          | 0                           | 0                     | 10                      | 10             |
| B     | 6                   | 0              | 0                          | 0                           | 0                     | 6                       | 6              |
| C     | 5                   | 0              | 0                          | 0                           | 0                     | 5                       | 5              |
| D     | 5                   | 0              | 0                          | 0                           | 0                     | 5                       | 5              |

Day:

25

Initials:

✓

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 10                  | 0              | 0                          | 0                           | 0                     | 10                      | 10             |
| B     | 6                   | 2              | 2                          | 0                           | 0                     | 4                       | 6              |
| C     | 5                   | 0              | 0                          | 0                           | 0                     | 5                       | 5              |
| D     | 5                   | 0              | 0                          | 0                           | 0                     | 5                       | 5              |

Day:

26

Initials:

✓

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 9                   | 1              | 1                          | 0                           | 0                     | 8                       | 9              |
| B     | 4                   | 2              | 2                          | 0                           | 0                     | 2                       | 6              |
| C     | 5                   | 2              | 2                          | 0                           | 0                     | 3                       | 5              |
| D     | 5                   | 1              | 1                          | 0                           | 0                     | 4                       | 6              |

verified by tech cult of 9



Concentration:

HW-300

Day:

27

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 8                   | 1              | 1                          | 1                           | 4                     | 7                       | 9              |
| B     | 2                   | 0              | 0                          | 2                           | 4                     | 2                       | 6              |
| C     | 3                   | 6              | 0                          | 2                           | 3                     | 3                       | 6              |
| D     | 4                   | 1              | 1                          | 1                           | 2                     | 3                       | 6              |

Day:

28

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 7                   | 0              | 0                          | 1                           | 2                     | 7                       | 9              |
| B     | 2                   | 1              | 1                          | 0                           | 4                     | 1                       | 6              |
| C     | 3                   | 1              | 1                          | 0                           | 3                     | 2                       | 6              |
| D     | 3                   | 1              | 1                          | 1                           | 3                     | 2                       | 6              |

Day:

29

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | /                   | /              | /                          | 0                           | 2                     | /                       | 9 (7 nymphs)   |
| B     | /                   | /              | /                          | 1                           | 3                     | /                       | 6 (4 nymphs)   |
| C     | /                   | /              | /                          | 1                           | 4                     | /                       | 6 (2 nymphs)   |
| D     | /                   | /              | /                          | 1                           | 4                     | /                       | 6 (2 nymphs)   |

Day:

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     |                     |                |                            |                             |                       |                         |                |

Day:

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     |                     |                |                            |                             |                       |                         |                |

Concentration: HCN-600

 Day: 22 Initials: \_\_\_\_\_ Date: \_\_\_\_\_

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 3                   | 0              | /                          | /                           | 0                     | 3                       | 3              |
| B     | 3                   | 0              | /                          | /                           | 0                     | 3                       | 3              |
| C     | 3                   | 0              | /                          | /                           | 0                     | 3                       | 3              |
| D     | 3                   | 0              | /                          | /                           | 0                     | 3                       | 3              |

 Day: 23 Initials: \_\_\_\_\_ Date: \_\_\_\_\_

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 3                   | 0              | 0                          | /                           | 0                     | 3                       | 3              |
| B     | 3                   | 0              | 0                          | /                           | 0                     | 3                       | 3              |
| C     | 2                   | 0              | 0                          | /                           | 0                     | 2                       | 2              |
| D     | 3                   | 0              | 0                          | /                           | 0                     | 3                       | 3              |

 Day: 24 Initials: \_\_\_\_\_ Date: \_\_\_\_\_

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 3                   | 0              | 0                          | /                           | 0                     | 3                       | 3              |
| B     | 3                   | 0              | 0                          | /                           | 0                     | 3                       | 3              |
| C     | 2                   | 0              | 0                          | /                           | 0                     | 2                       | 2              |
| D     | 3                   | 0              | 0                          | /                           | 0                     | 3                       | 3              |

 Day: 25 Initials: \_\_\_\_\_ Date: \_\_\_\_\_

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 2                   | 0              | 0                          | /                           | 0                     | 2                       | 2              |
| B     | 2                   | 0              | 0                          | /                           | 0                     | 2                       | 2              |
| C     | 2                   | 0              | 0                          | /                           | 0                     | 2                       | 2              |
| D     | 3                   | 0              | 0                          | /                           | 0                     | 3                       | 3              |

 Day: 26 Initials: \_\_\_\_\_ Date: \_\_\_\_\_

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 2                   | 0              | 0                          | =                           | 0                     | 2                       | 2              |
| B     | 2                   | 0              | 0                          | =                           | 0                     | 2                       | 2              |
| C     | 2                   | 0              | 0                          | =                           | 0                     | 2                       | 2              |
| D     | 2                   | 0              | 0                          | =                           | 0                     | 2                       | 2              |



Concentration:

HW-600

Day:

27

Initials:

—

Date:

—

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | <u>2</u>            | <u>0</u>       | <u>0</u>                   | <u>0</u>                    | <u>0</u>              | <u>2</u>                | <u>2</u>       |
| B     | <u>1</u>            | <u>1</u>       | <u>0</u>                   | <u>0</u>                    | <u>1</u>              | <u>1</u>                | <u>0</u>       |
| C     | <u>2</u>            | <u>0</u>       | <u>0</u>                   | <u>0</u>                    | <u>0</u>              | <u>2</u>                | <u>2</u>       |
| D     | <u>2</u>            | <u>0</u>       | <u>0</u>                   | <u>0</u>                    | <u>0</u>              | <u>2</u>                | <u>3</u>       |

Day:

28

Initials:

—

Date:

—

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | <u>2</u>            | <u>0</u>       | <u>0</u>                   | <u>0</u>                    | <u>0</u>              | <u>2</u>                | <u>2</u>       |
| B     | <u>1</u>            | <u>1</u>       | <u>0</u>                   | <u>0</u>                    | <u>1</u>              | <u>1</u>                | <u>0</u>       |
| C     | <u>2</u>            | <u>0</u>       | <u>0</u>                   | <u>0</u>                    | <u>0</u>              | <u>2</u>                | <u>2</u>       |
| D     | <u>2</u>            | <u>0</u>       | <u>0</u>                   | <u>0</u>                    | <u>0</u>              | <u>2</u>                | <u>3</u>       |

Day:

29

Initials:

—

Date:

—

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival     |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|--------------------|
| A     | <u>—</u>            | <u>—</u>       | <u>0</u>                   | <u>0</u>                    | <u>0</u>              | <u>—</u>                | <u>2 (2 nymph)</u> |
| B     | <u>—</u>            | <u>—</u>       | <u>0</u>                   | <u>0</u>                    | <u>0</u>              | <u>—</u>                | <u>0</u>           |
| C     | <u>—</u>            | <u>—</u>       | <u>0</u>                   | <u>0</u>                    | <u>0</u>              | <u>—</u>                | <u>2 (2 nymph)</u> |
| D     | <u>—</u>            | <u>—</u>       | <u>0</u>                   | <u>0</u>                    | <u>0</u>              | <u>—</u>                | <u>3 (2 nymph)</u> |

Day:

—

Initials:

—

Date:

—

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     |                     |                |                            |                             |                       |                         |                |

Day:

—

Initials:

—

Date:

—

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             |                       |                         |                |
| B     |                     |                |                            |                             |                       |                         |                |
| C     |                     |                |                            |                             |                       |                         |                |
| D     |                     |                |                            |                             |                       |                         |                |

# Organism Weights

## Bench Sheet

Client NAU 104 Sample SP1712-05 Organism MA Batch HW

| Item Weighed          | Date       | Initials | Balance* |
|-----------------------|------------|----------|----------|
| dried pan             | 20.2.09.13 | SW       | WATER    |
| dried pan + organisms | 20.2.09.13 | HW       | HW       |

Initial Weight (mg):  
Final Weight (mg):

\* same balance must be used for initial and final weights  
\* for FM/HA/CT, must use scale with 0.01 mg accuracy

| Replicate | Initial | Final |
|-----------|---------|-------|
| a         | 996.59  |       |
| b         | 993.29  |       |
| c         | 992.34  |       |
| d         | 993.41  |       |
| e         |         |       |

| Initial | Final   |
|---------|---------|
| 994.13  | 997.07  |
| 995.31  | 997.46  |
| 991.30  | 993.74  |
| 1004.81 | 1005.46 |

| Initial | Final |
|---------|-------|
| 996.05  |       |
| 993.14  |       |
| 996.02  |       |
| 991.05  |       |

| Initial | Final   |
|---------|---------|
| 988.06  | 990.86  |
| 993.16  | 994.89  |
| 1003.43 | 1005.98 |
| 994.08  | 996.82  |

| Initial | Final |
|---------|-------|
| 1004.71 |       |
| 996.68  |       |
| 993.15  |       |
| 992.79  |       |

| Initial | Final  |
|---------|--------|
| 991.23  | 992.53 |
| 988.74  | 990.29 |
| 990.54  | 994.01 |
| 991.96  | 994.66 |

| Initial | Final |
|---------|-------|
| 981.34  |       |
| 996.66  |       |
| 991.85  |       |
| 991.37  |       |

| Initial | Final  |
|---------|--------|
| 993.13  | 993.99 |
| 994.13  | 994.95 |
| 990.90  | 991.71 |
| 991.34  | 993.90 |

| Initial | Final |
|---------|-------|
| 994.13  |       |
| 995.99  |       |
| 990.89  |       |
| 990.89  |       |

| Initial | Final  |
|---------|--------|
| 994.29  |        |
| 996.10  |        |
| 991.40  |        |
| 995.96  | 996.86 |

| Initial | Final |
|---------|-------|
|         |       |
|         |       |
|         |       |
|         |       |

| Initial | Final |
|---------|-------|
|         |       |
|         |       |
|         |       |
|         |       |

Balance Calibration Check:

first pan weighed: HW 300N-A Initial 996.59 Final 1000.77  
weight of first pan: 996.86  
first pan after all other pans weighed: 996.50 Initial 996.50 Final 996.90

% difference < 5%: Yes/No Yes

$$\% \text{ difference} = \frac{(\text{initial weight} - \text{reweight})}{(\text{initial weight} + \text{reweight}) / 2} \times 100\%$$

\*\* no negative numbers, consistent values across replicates

Test Validity Met: Yes/No/NA

Results are Logical\*\*: Yes/No

If "no" is circled for any parameter, notify Lab Supervisor/  
QA Group to determine appropriate action

Reviewed By: \_\_\_\_\_ Date Reviewed: \_\_\_\_\_

## CETIS Analytical Report

Report Date: 12 Dec-18 16:22 (p 1 of 3)  
 Test Code/ID: SP1718-015 HW / 20-9534-6631

| Ephemeroptera (Mayfly) 28-d Test |  |                                          |  | Nautilus Environmental Calgary    |  |             |  |
|----------------------------------|--|------------------------------------------|--|-----------------------------------|--|-------------|--|
| <b>Analysis ID:</b> 20-3844-1953 |  | <b>Endpoint:</b> 28d Survival Rate       |  | <b>CETIS Version:</b> CETISv1.9.4 |  |             |  |
| <b>Analyzed:</b> 12 Dec-18 16:22 |  | <b>Analysis:</b> Linear Regression (GLM) |  | <b>Status Level:</b> 1            |  |             |  |
| <b>Batch ID:</b> 03-9959-9143    |  | <b>Test Type:</b> Growth-Survival (7d)   |  | <b>Analyst:</b> Madison Lehti     |  |             |  |
| <b>Start Date:</b> 29 Aug-18     |  | <b>Protocol:</b> Not Applicable          |  | <b>Diluent:</b>                   |  |             |  |
| <b>Ending Date:</b> 26 Sep-18    |  | <b>Species:</b> Ephemeroptera            |  | <b>Brine:</b>                     |  |             |  |
| <b>Test Length:</b> 28d 0h       |  | <b>Taxon:</b>                            |  | <b>Source:</b>                    |  | <b>Age:</b> |  |
| <b>Sample ID:</b> 13-1643-7496   |  | <b>Code:</b> SP1718-015 HW               |  | <b>Project:</b>                   |  |             |  |
| <b>Sample Date:</b> 17 Aug-18    |  | <b>Material:</b> chloride                |  | <b>Source:</b> Equilibrium        |  |             |  |
| <b>Receipt Date:</b> 17 Aug-18   |  | <b>CAS (PC):</b>                         |  | <b>Station:</b> na                |  |             |  |
| <b>Sample Age:</b> 12d 0h        |  | <b>Client:</b> Equilibrium               |  |                                   |  |             |  |

## Linear Regression Options

| Model Name | Link Function                | Threshold Option  | Thresh | Optimized | Pooled | Het Corr | Weighted |
|------------|------------------------------|-------------------|--------|-----------|--------|----------|----------|
| Log-Angle  | $\eta = \arcsin[\sqrt{\pi}]$ | Control Threshold | 0.225  | Yes       | No     | No       | Yes      |

## Regression Summary

| Iters | LL     | AICc  | BIC   | Mu   | Sigma | Adj R2 | F Stat | Critical | P-Value | Decision( $\alpha$ :5%)     |
|-------|--------|-------|-------|------|-------|--------|--------|----------|---------|-----------------------------|
| 9     | -32.87 | 72.94 | 75.28 | 2.44 |       | 0.8522 | 1.387  | 3.16     | 0.2790  | Non-Significant Lack of Fit |

## Point Estimates

| Level | mgL   | 95% LCL | 95% UCL |
|-------|-------|---------|---------|
| LC5   | 329.7 | 84.71   | 433.5   |
| LC10  | 356.1 | 108     | 455.5   |
| LC15  | 378.5 | 130.6   | 474     |
| LC20  | 399   | 154     | 491     |
| LC25  | 418.6 | 178.7   | 507.5   |
| LC40  | 476.4 | 264.6   | 558.7   |
| LC50  | 516.4 | 334.6   | 599.7   |

## Regression Parameters

| Parameter | Estimate | Std Error | 95% LCL | 95% UCL | t Stat | P-Value | Decision( $\alpha$ :5%) |
|-----------|----------|-----------|---------|---------|--------|---------|-------------------------|
| Threshold | 0.2773   | 0.04104   | 0.1969  | 0.3577  | 6.757  | 1.1E-06 | Significant Parameter   |
| Slope     | 2.872    | 1.006     | 0.9003  | 4.844   | 2.855  | 0.0095  | Significant Parameter   |
| Intercept | -7.007   | 2.788     | -12.47  | -1.542  | -2.513 | 0.0202  | Significant Parameter   |

## ANOVA Table

| Source      | Sum Squares | Mean Square | DF | F Stat | P-Value  | Decision( $\alpha$ :5%) |
|-------------|-------------|-------------|----|--------|----------|-------------------------|
| Model       | 100.8       | 50.39       | 2  | 67.32  | <1.0E-37 | Significant             |
| Lack of Fit | 2.951       | 0.9835      | 3  | 1.387  | 0.2790   | Non-Significant         |
| Pure Error  | 12.77       | 0.7094      | 18 |        |          |                         |
| Residual    | 15.72       | 0.7485      | 21 |        |          |                         |

## Residual Analysis

| Attribute       | Method                           | Test Stat | Critical | P-Value | Decision( $\alpha$ :5%)       |
|-----------------|----------------------------------|-----------|----------|---------|-------------------------------|
| Goodness-of-Fit | Pearson Chi-Sq GOF Test          | 15.72     | 32.67    | 0.7852  | Non-Significant Heterogeneity |
|                 | Likelihood Ratio GOF Test        | 19.93     | 32.67    | 0.5260  | Non-Significant Heterogeneity |
| Extreme Value   | Grubbs Extreme Value Test        | 2.419     | 2.802    | 0.2392  | No Outliers Detected          |
| Variances       | Mod Levene Equality of Variance  | 0.7571    | 2.773    | 0.5920  | Equal Variances               |
| Distribution    | Shapiro-Wilk W Normality Test    | 0.9744    | 0.9169   | 0.7747  | Normal Distribution           |
|                 | Anderson-Darling A2 Normality Te | 0.3261    | 2.492    | 0.5380  | Normal Distribution           |



# CETIS Analytical Report

Report Date: 12 Dec-18 16:22 (p 2 of 3)  
 Test Code/ID: SP1718-015 HW / 20-9534-6631

## Ephemeroptera (Mayfly) 28-d Test Nautilus Environmental Calgary

Analysis ID: 20-3844-1953      Endpoint: 28d Survival Rate      CETIS Version: CETISv1.9.4  
 Analyzed: 12 Dec-18 16:22      Analysis: Linear Regression (GLM)      Status Level: 1

| 7d Survival Rate Summary |      |       | Calculated Variate(A/B) |        |        |         |         |        |         |    |    |
|--------------------------|------|-------|-------------------------|--------|--------|---------|---------|--------|---------|----|----|
| Conc-mgL                 | Code | Count | Mean                    | Min    | Max    | Std Err | Std Dev | CV%    | %Effect | A  | B  |
| 4.44                     | N    | 4     | 0.7750                  | 0.7000 | 0.8000 | 0.0250  | 0.0500  | 6.45%  | 0.0%    | 31 | 40 |
| 80.93                    |      | 4     | 0.7500                  | 0.6000 | 0.9000 | 0.0646  | 0.1291  | 17.21% | 3.23%   | 30 | 40 |
| 166                      |      | 4     | 0.6417                  | 0.5000 | 0.8000 | 0.0629  | 0.1258  | 19.61% | 17.2%   | 25 | 39 |
| 324.67                   |      | 4     | 0.7000                  | 0.6000 | 1.0000 | 0.1000  | 0.2000  | 28.57% | 9.68%   | 27 | 39 |
| 641.67                   |      | 4     | 0.1750                  | 0.0000 | 0.3000 | 0.0629  | 0.1258  | 71.90% | 77.42%  | 7  | 40 |
| 1300                     |      | 4     | 0.0000                  | 0.0000 | 0.0000 | 0.0000  | 0.0000  |        | 100.0%  | 0  | 40 |

| 7d Survival Rate Detail |      |        |        |        |        |
|-------------------------|------|--------|--------|--------|--------|
| Conc-mgL                | Code | Rep 1  | Rep 2  | Rep 3  | Rep 4  |
| 4.44                    | N    | 0.7000 | 0.8000 | 0.8000 | 0.8000 |
| 80.93                   |      | 0.7000 | 0.9000 | 0.6000 | 0.8000 |
| 166                     |      | 0.8000 | 0.6667 | 0.6000 | 0.5000 |
| 324.67                  |      | 1.0000 | 0.6000 | 0.6000 | 0.6000 |
| 641.67                  |      | 0.2000 | 0.0000 | 0.2000 | 0.3000 |
| 1300                    |      | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

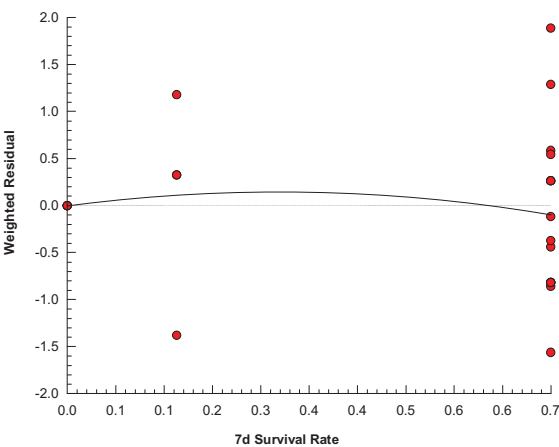
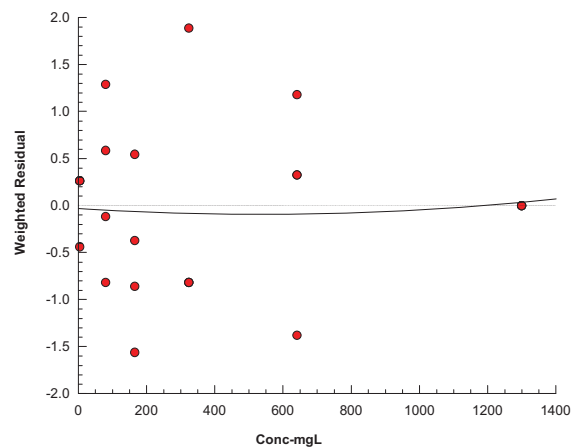
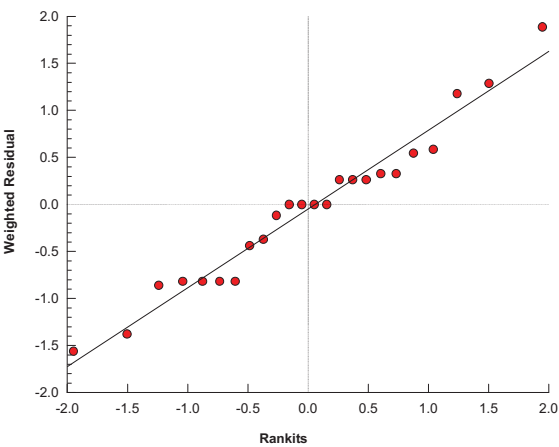
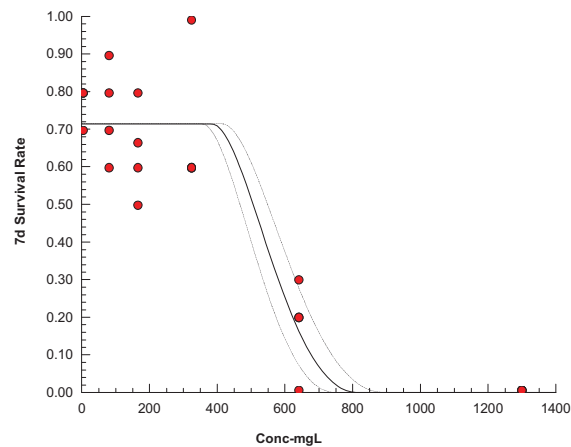
| 7d Survival Rate Binomials |      |       |       |       |       |
|----------------------------|------|-------|-------|-------|-------|
| Conc-mgL                   | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 |
| 4.44                       | N    | 7/10  | 8/10  | 8/10  | 8/10  |
| 80.93                      |      | 7/10  | 9/10  | 6/10  | 8/10  |
| 166                        |      | 8/10  | 6/9   | 6/10  | 5/10  |
| 324.67                     |      | 9/9   | 6/10  | 6/10  | 6/10  |
| 641.67                     |      | 2/10  | 0/10  | 2/10  | 3/10  |
| 1300                       |      | 0/10  | 0/10  | 0/10  | 0/10  |



Ephemeroptera (Mayfly) 28-d Test Nautilus Environmental Calgary

|                           |                                   |                            |
|---------------------------|-----------------------------------|----------------------------|
| Analysis ID: 20-3844-1953 | Endpoint: 28d Survival Rate       | CETIS Version: CETISv1.9.4 |
| Analyzed: 12 Dec-18 16:22 | Analysis: Linear Regression (GLM) | Status Level: 1            |

Graphics Log-angle: arcsin[sqr[π]] = α + β · log[x]



## CETIS Analytical Report

Report Date: 12 Dec-18 16:21 (p 1 of 3)  
 Test Code/ID: SP1718-015 HW / 20-9534-6631

| Ephemeroptera (Mayfly) 28-d Test |                 |            |                         | Nautilus Environmental Calgary |               |
|----------------------------------|-----------------|------------|-------------------------|--------------------------------|---------------|
| Analysis ID:                     | 07-2273-5797    | Endpoint:  | 28d Emergence Rate      | CETIS Version:                 | CETISv1.9.4   |
| Analyzed:                        | 12 Dec-18 16:21 | Analysis:  | Linear Regression (GLM) | Status Level:                  | 1             |
| Batch ID:                        | 03-9959-9143    | Test Type: | Growth-Survival (7d)    | Analyst:                       | Madison Lehti |
| Start Date:                      | 29 Aug-18       | Protocol:  | Not Applicable          | Diluent:                       |               |
| Ending Date:                     | 26 Sep-18       | Species:   | Ephemeroptera           | Brine:                         |               |
| Test Length:                     | 28d 0h          | Taxon:     |                         | Source:                        | Age:          |
| Sample ID:                       | 13-1643-7496    | Code:      | SP1718-015 HW           | Project:                       |               |
| Sample Date:                     | 17 Aug-18       | Material:  | chloride                | Source:                        | Equilibrium   |
| Receipt Date:                    | 17 Aug-18       | CAS (PC):  |                         | Station:                       | na            |
| Sample Age:                      | 12d 0h          | Client:    | Equilibrium             |                                |               |

## Linear Regression Options

| Model Name   | Link Function               | Threshold Option  | Thresh | Optimized | Pooled | Het Corr | Weighted |
|--------------|-----------------------------|-------------------|--------|-----------|--------|----------|----------|
| Log-Gompertz | $\eta = \log[-\log[1-\pi]]$ | Control Threshold | 0.25   | Yes       | No     | No       | Yes      |

## Regression Summary

| Iters | LL     | AICc  | BIC   | Mu   | Sigma | Adj R2 | F Stat | Critical | P-Value | Decision( $\alpha$ :5%)     |
|-------|--------|-------|-------|------|-------|--------|--------|----------|---------|-----------------------------|
| 23    | -29.27 | 65.73 | 68.07 | 2.54 |       | 0.8367 | 2.498  | 3.16     | 0.0924  | Non-Significant Lack of Fit |

## Point Estimates

| Level | mgL   | 95% LCL | 95% UCL |
|-------|-------|---------|---------|
| LC5   | 53.69 | 6.272   | 113.4   |
| LC10  | 84.41 | 15.2    | 154.6   |
| LC15  | 110.8 | 25.85   | 186.7   |
| LC20  | 135.3 | 38.06   | 214.6   |
| LC25  | 158.7 | 51.81   | 240.4   |
| LC40  | 227.6 | 103.1   | 313.3   |
| LC50  | 275.7 | 147.3   | 364     |

## Regression Parameters

| Parameter | Estimate | Std Error | 95% LCL | 95% UCL | t Stat | P-Value | Decision( $\alpha$ :5%) |
|-----------|----------|-----------|---------|---------|--------|---------|-------------------------|
| Threshold | 0.3019   | 0.06447   | 0.1756  | 0.4283  | 4.683  | 1.3E-04 | Significant Parameter   |
| Slope     | 3.664    | 0.9218    | 1.858   | 5.471   | 3.975  | 6.9E-04 | Significant Parameter   |
| Intercept | -9.309   | 2.413     | -14.04  | -4.579  | -3.858 | 9.1E-04 | Significant Parameter   |

## ANOVA Table

| Source      | Sum Squares | Mean Square | DF | F Stat | P-Value  | Decision( $\alpha$ :5%) |
|-------------|-------------|-------------|----|--------|----------|-------------------------|
| Model       | 74.5        | 37.25       | 2  | 59.94  | <1.0E-37 | Significant             |
| Lack of Fit | 3.836       | 1.279       | 3  | 2.498  | 0.0924   | Non-Significant         |
| Pure Error  | 9.213       | 0.5118      | 18 |        |          |                         |
| Residual    | 13.05       | 0.6214      | 21 |        |          |                         |

## Residual Analysis

| Attribute       | Method                           | Test Stat | Critical | P-Value | Decision( $\alpha$ :5%)       |
|-----------------|----------------------------------|-----------|----------|---------|-------------------------------|
| Goodness-of-Fit | Pearson Chi-Sq GOF Test          | 13.05     | 32.67    | 0.9069  | Non-Significant Heterogeneity |
|                 | Likelihood Ratio GOF Test        | 14.31     | 32.67    | 0.8560  | Non-Significant Heterogeneity |
| Extreme Value   | Grubbs Extreme Value Test        | 2.314     | 2.802    | 0.3461  | No Outliers Detected          |
| Variances       | Mod Levene Equality of Variance  | 1.278     | 2.773    | 0.3163  | Equal Variances               |
| Distribution    | Shapiro-Wilk W Normality Test    | 0.9613    | 0.9169   | 0.4652  | Normal Distribution           |
|                 | Anderson-Darling A2 Normality Te | 0.5362    | 2.492    | 0.1734  | Normal Distribution           |

# CETIS Analytical Report

Report Date: 12 Dec-18 16:21 (p 2 of 3)  
 Test Code/ID: SP1718-015 HW / 20-9534-6631

## Ephemeroptera (Mayfly) 28-d Test Nautilus Environmental Calgary

Analysis ID: 07-2273-5797      Endpoint: 28d Emergence Rate      CETIS Version: CETISv1.9.4  
 Analyzed: 12 Dec-18 16:21      Analysis: Linear Regression (GLM)      Status Level: 1

| 7d Survival Rate Summary |      |       | Calculated Variate(A/B) |        |        |         |         |         |         |    |    |
|--------------------------|------|-------|-------------------------|--------|--------|---------|---------|---------|---------|----|----|
| Conc-mg/L                | Code | Count | Mean                    | Min    | Max    | Std Err | Std Dev | CV%     | %Effect | A  | B  |
| 4.44                     | N    | 4     | 0.7500                  | 0.7000 | 0.8000 | 0.0289  | 0.0577  | 7.70%   | 0.0%    | 30 | 40 |
| 80.93                    |      | 4     | 0.5750                  | 0.5000 | 0.7000 | 0.0479  | 0.0957  | 16.65%  | 23.33%  | 23 | 40 |
| 166                      |      | 4     | 0.4472                  | 0.2222 | 0.6667 | 0.0930  | 0.1860  | 41.59%  | 40.37%  | 17 | 38 |
| 324.67                   |      | 4     | 0.3806                  | 0.2222 | 0.5000 | 0.0578  | 0.1156  | 30.38%  | 49.26%  | 15 | 39 |
| 641.67                   |      | 4     | 0.0250                  | 0.0000 | 0.1000 | 0.0250  | 0.0500  | 200.00% | 96.67%  | 1  | 40 |
| 1300                     |      | 4     | 0.0000                  | 0.0000 | 0.0000 | 0.0000  | 0.0000  |         | 100.0%  | 0  | 40 |

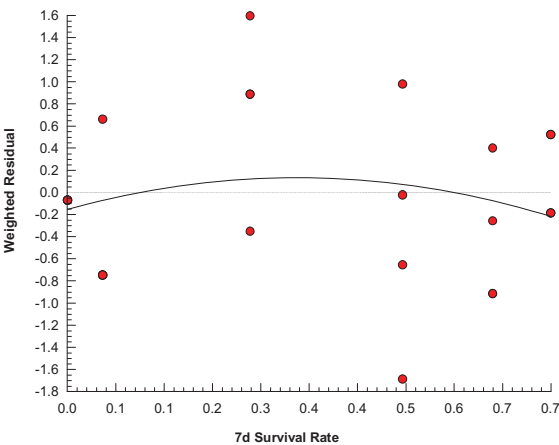
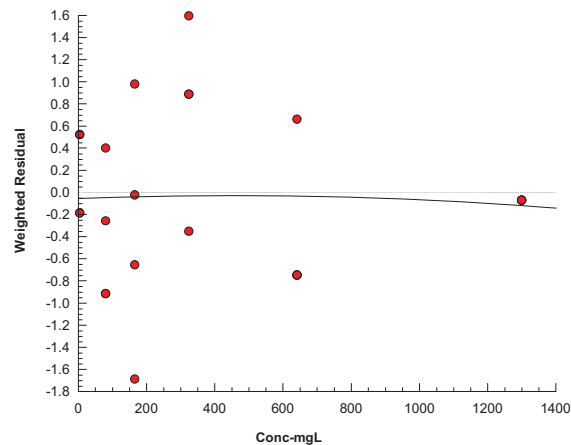
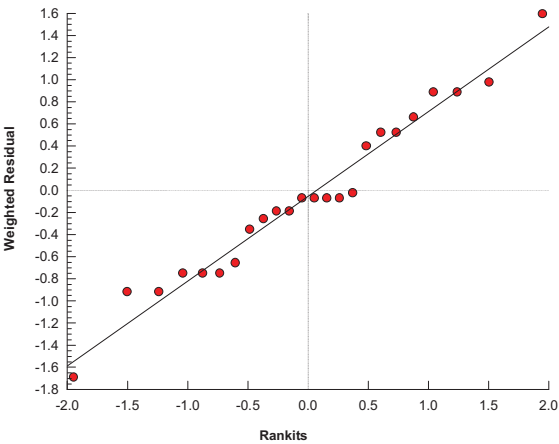
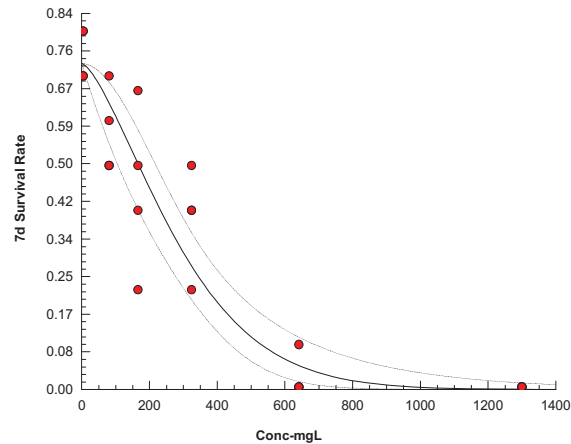
| 7d Survival Rate Detail |      |        |        |        |        |
|-------------------------|------|--------|--------|--------|--------|
| Conc-mg/L               | Code | Rep 1  | Rep 2  | Rep 3  | Rep 4  |
| 4.44                    | N    | 0.7000 | 0.8000 | 0.8000 | 0.7000 |
| 80.93                   |      | 0.7000 | 0.5000 | 0.5000 | 0.6000 |
| 166                     |      | 0.4000 | 0.2222 | 0.6667 | 0.5000 |
| 324.67                  |      | 0.2222 | 0.5000 | 0.4000 | 0.4000 |
| 641.67                  |      | 0.0000 | 0.0000 | 0.0000 | 0.1000 |
| 1300                    |      | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

| 7d Survival Rate Binomials |      |       |       |       |       |
|----------------------------|------|-------|-------|-------|-------|
| Conc-mg/L                  | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 |
| 4.44                       | N    | 7/10  | 8/10  | 8/10  | 7/10  |
| 80.93                      |      | 7/10  | 5/10  | 5/10  | 6/10  |
| 166                        |      | 4/10  | 2/9   | 6/9   | 5/10  |
| 324.67                     |      | 2/9   | 5/10  | 4/10  | 4/10  |
| 641.67                     |      | 0/10  | 0/10  | 0/10  | 1/10  |
| 1300                       |      | 0/10  | 0/10  | 0/10  | 0/10  |

Ephemeroptera (Mayfly) 28-d Test Nautilus Environmental Calgary

|                           |                                   |                            |
|---------------------------|-----------------------------------|----------------------------|
| Analysis ID: 07-2273-5797 | Endpoint: 28d Emergence Rate      | CETIS Version: CETISv1.9.4 |
| Analyzed: 12 Dec-18 16:21 | Analysis: Linear Regression (GLM) | Status Level: 1            |

Graphics Log-Gompertz:  $\log[-\log[1-\pi]=\alpha+\beta\cdot\log[x]]$





## CETIS Analytical Report

Report Date: 04 Dec-18 10:14 (p 1 of 2)  
 Test Code/ID: SP1718-015 HW / 20-9534-6631

| Ephemeroptera (Mayfly) 28-d Test |                 |            |                              | Nautilus Environmental Calgary |               |
|----------------------------------|-----------------|------------|------------------------------|--------------------------------|---------------|
| Analysis ID:                     | 03-6150-6211    | Endpoint:  | Mean Dry Weight-mg           | CETIS Version:                 | CETISv1.9.4   |
| Analyzed:                        | 04 Dec-18 10:14 | Analysis:  | Linear Interpolation (ICPIN) | Status Level:                  | 1             |
| Batch ID:                        | 03-9959-9143    | Test Type: | Growth-Survival (7d)         | Analyst:                       | Madison Lehti |
| Start Date:                      | 29 Aug-18       | Protocol:  | Not Applicable               | Diluent:                       |               |
| Ending Date:                     | 26 Sep-18       | Species:   | Ephemeroptera                | Brine:                         |               |
| Test Length:                     | 28d 0h          | Taxon:     |                              | Source:                        | Age:          |
| Sample ID:                       | 13-1643-7496    | Code:      | SP1718-015 HW                | Project:                       |               |
| Sample Date:                     | 17 Aug-18       | Material:  | chloride                     | Source:                        | Equilibrium   |
| Receipt Date:                    | 17 Aug-18       | CAS (PC):  |                              | Station:                       | na            |
| Sample Age:                      | 12d 0h          | Client:    | Equilibrium                  |                                |               |

## Linear Interpolation Options

| X Transform | Y Transform | Seed    | Resamples | Exp 95% CL | Method                  |
|-------------|-------------|---------|-----------|------------|-------------------------|
| Log(X+1)    | Linear      | 1105839 | 200       | Yes        | Two-Point Interpolation |

## Residual Analysis

| Attribute     | Method                    | Test Stat | Critical | P-Value | Decision(α:5%)                    |
|---------------|---------------------------|-----------|----------|---------|-----------------------------------|
| Extreme Value | Grubbs Extreme Value Test | 2.142     | 2.62     | 0.3671  | No Outliers Detected              |
| Control Trend | Mann-Kendall Trend Test   | 2.142     |          | 0.7391  | Non-Significant Trend in Controls |

## Point Estimates

| Level | mgL    | 95% LCL | 95% UCL |
|-------|--------|---------|---------|
| IC5   | >641.7 | n/a     | n/a     |
| IC10  | >641.7 | n/a     | n/a     |
| IC15  | >641.7 | n/a     | n/a     |
| IC20  | >641.7 | n/a     | n/a     |
| IC25  | >641.7 | n/a     | n/a     |
| IC40  | >641.7 | n/a     | n/a     |
| IC50  | >641.7 | n/a     | n/a     |

## Mean Dry Weight-mg Summary

|          |      |       | Calculated Variate |        |        |         |        |         | Isotonic Variate |         |
|----------|------|-------|--------------------|--------|--------|---------|--------|---------|------------------|---------|
| Conc-mgL | Code | Count | Mean               | Min    | Max    | Std Dev | CV%    | %Effect | Mean             | %Effect |
| 4.44     | N    | 4     | 0.3777             | 0.2688 | 0.5171 | 0.1131  | 29.95% | 0.0%    | 0.5894           | 0.0%    |
| 80.93    |      | 4     | 0.415              | 0.336  | 0.51   | 0.08236 | 19.85% | -9.86%  | 0.5894           | 0.0%    |
| 166      |      | 4     | 0.5358             | 0.325  | 0.7    | 0.1562  | 29.16% | -41.86% | 0.5894           | 0.0%    |
| 324.67   |      | 4     | 0.7184             | 0.43   | 1.013  | 0.2378  | 33.11% | -90.19% | 0.5894           | 0.0%    |
| 641.67   |      | 1     | 0.9                | 0.9    | 0.9    | 0       | 0.00%  | -138.3% | 0.5894           | 0.0%    |

## Mean Dry Weight-mg Detail

| Conc-mgL | Code | Rep 1  | Rep 2  | Rep 3  | Rep 4  |
|----------|------|--------|--------|--------|--------|
| 4.44     | N    | 0.42   | 0.2688 | 0.305  | 0.5171 |
| 80.93    |      | 0.3571 | 0.336  | 0.51   | 0.4567 |
| 166      |      | 0.325  | 0.7    | 0.5783 | 0.54   |
| 324.67   |      | 0.43   | 0.716  | 1.013  | 0.715  |
| 641.67   |      | 0.9    |        |        |        |

# CETIS Analytical Report

Report Date: 04 Dec-18 10:14 (p 2 of 2)  
Test Code/ID: SP1718-015 HW / 20-9534-6631

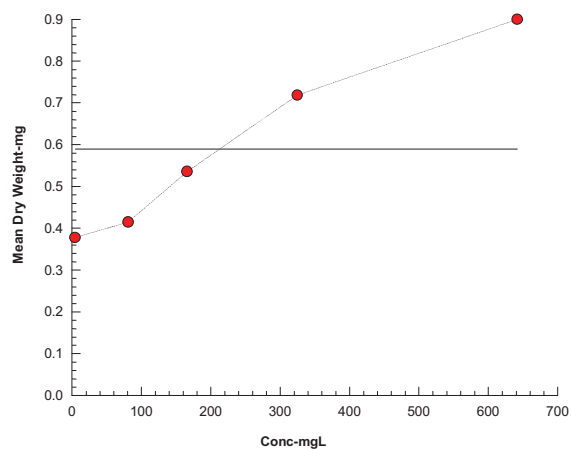
## Ephemeroptera (Mayfly) 28-d Test

Nautilus Environmental Calgary

Analysis ID: 03-6150-6211      Endpoint: Mean Dry Weight-mg  
Analyzed: 04 Dec-18 10:14      Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4  
Status Level: 1

### Graphics



## **APPENDIX D – Very Hard Water Toxicity Test Data**

7

very hard  
water  
c/nw

Water Type: Client: Equilibrium Sample Reference: SP1718-015

| Date       | Day | Initials | Chem Cart | Fed         | Daily Data Review             |
|------------|-----|----------|-----------|-------------|-------------------------------|
| 2018/08/31 | 0   | ST       | 3         | 1 slide 2mL | FP                            |
| 2018/09/01 | 1   | ST       | 3         | 0.5mL       | SS                            |
| 2018/09/02 | 2   | ML       | 3         | 0.5mL       | LC                            |
| 2018/09/03 | 3   | ML       | 3         | 0.5mL       | KL                            |
| 2018/09/04 | 4   | ML       | 3         | 0.5mL       | ML                            |
| 2018/09/05 | 5   | ML/ST    | 2         | 1 slide 2mL | ML - transferred to 1L jars   |
| 2018/09/06 | 6   | ST       | 2         | 1mL         | ML                            |
| 2018/09/07 | 7   | ST       | 2         | 1mL slide   | UF                            |
| 2018/09/08 | 8   | ST       | 2         | 1mL         | UF                            |
| 2018/09/09 | 9   | ML       | 3         | 2mL         | KL                            |
| 2018/09/10 | 10  | ML       | 2         | 1mL         | KL                            |
| 2018/09/11 | 11  | ML/CB    | 2         | 1 slide     | ST                            |
| 2018/09/12 | 12  | ST/ML    | 2         | 1 slide     | SS - 2mL                      |
| 2018/09/13 | 13  | CB/ST    | 2         | 1 slide     | FP                            |
| 2018/09/14 | 14  | CB/ST    | 2         |             | FP                            |
| 2018/09/15 | 15  | ST       | 2         |             | UF * aerated lower DO vessels |
| 2018/09/16 | 16  | CB       | 3         |             | FP                            |
| 2018/09/17 | 17  | ST       | 3         |             | CB                            |
| 2018/09/18 | 18  | ST/ML    | 3         |             | FP aerated                    |
| 2018/09/19 | 19  | ML/ST    | 2         |             | UF                            |
| 2018/09/20 | 20  | ML/ST    | 3         |             | KL                            |
| 2018/09/21 | 21  | ML/ST    | 2         |             | KL                            |
| 2018/09/22 | 22  | ML       | 2         |             | KL                            |
| 2018/09/23 | 23  | ML/ST    | 2         |             | CB                            |
| 2018/09/24 | 24  | ST       | 2         |             | FP                            |
| 2018/09/25 | 25  | ST/ML    | 2         |             | KL                            |
| 2018/09/26 | 26  | ST/ML    | 2         |             | KL                            |
| 2018/09/27 | 27  | ML/ST    | 2         |             | KL                            |
| 2018/09/28 | 28  | ML       | 2         |             | KL                            |

Reviewed By: ML/ST

Date Reviewed: 2018/10/22 -  
2018/11/02



Water Type: vhw Client: Equilibrium Sample Reference: SP1718-015

**Water Chemistries**

| conc. (mg/L Cl) | Control       | 75 | 150 | 300 | 600 | 1200 |
|-----------------|---------------|----|-----|-----|-----|------|
| day             | New Solutions |    |     |     |     |      |

|               |    |                   |     |     |     |     |   |
|---------------|----|-------------------|-----|-----|-----|-----|---|
| pH<br>(units) | 0  | 7.7               | 8.2 | 8.3 | 8.3 | 8.3 |   |
|               | 5  | 8.3               | 8.3 | 8.3 | 8.3 | 8.3 | X |
|               | 7  | 8.3               | 8.5 | 8.5 | 8.5 | 8.4 |   |
|               | 10 | 8.5               | 8.6 | 8.6 | 8.6 | 8.5 |   |
|               | 12 | 8.6               | 8.6 | 8.6 | 8.6 | 8.5 |   |
|               | 14 | 8.5               | 8.5 | 8.5 | 8.5 | 8.5 |   |
|               | 17 | 8.8 <sup>st</sup> | 8.4 | 8.4 | 8.5 | 8.4 |   |
|               | 19 | 8.5               | 8.5 | 8.5 | 8.5 | 8.4 |   |
|               | 21 | 8.6               | 8.6 | 8.6 | 8.5 | 8.5 |   |
|               | 24 | 8.5               | 8.5 | 8.5 | 8.5 | 8.6 |   |
|               | 26 | 8.4               | 8.4 | 8.4 | 8.4 | 8.4 |   |
|               |    |                   |     |     |     |     |   |

|               |    |                   |      |      |      |      |      |
|---------------|----|-------------------|------|------|------|------|------|
| EC<br>(uS/cm) | 0  | 901               | 1105 | 1312 | 1836 | 2690 | 4460 |
|               | 5  | 925               | 1149 | 1344 | 1986 | 2850 | X    |
|               | 7  | 875               | 1119 | 1344 | 1879 | 2710 |      |
|               | 10 | 921               | 1123 | 1330 | 1902 | 2770 |      |
|               | 12 | 864               | 1077 | 1279 | 1824 | 2520 |      |
|               | 14 | 889               | 1128 | 1293 | 1946 | 2740 |      |
|               | 17 | 945 <sup>st</sup> | 1153 | 1435 | 2340 | 3130 |      |
|               | 19 | 947               | 1126 | 1361 | 1776 | 2700 |      |
|               | 21 | 954               | 1127 | 1367 | 1804 | 2690 |      |
|               | 24 | 944               | 1124 | 1371 | 1831 | 2710 |      |
|               | 26 | 875 <sup>st</sup> | 1120 | 1372 | 1812 | 2740 |      |
|               |    |                   |      |      |      |      |      |

\*2760

Reviewed By: ML/st

Date Reviewed: 20181022 -  
20181102

Water Type: vhw Client: Equilibrium Sample Reference: SP1718-015

**Water Chemistries**

| conc. (mg/L Cl) | Control       | 75 | 150 | 300 | 600 | 1200 |
|-----------------|---------------|----|-----|-----|-----|------|
| day             | New Solutions |    |     |     |     |      |

|              |    |     |     |     |                   |     |     |
|--------------|----|-----|-----|-----|-------------------|-----|-----|
| DO<br>(mg/L) | 0  | 6.9 | 7.1 | 7.1 | 7.1 <sup>ST</sup> | 7.1 | 7.1 |
|              | 5  | 7.9 | 7.8 | 7.8 | 7.7               | 7.4 | X   |
|              | 7  | 7.4 | 7.4 | 7.3 | 7.3               | 7.3 |     |
|              | 10 | 7.4 | 7.4 | 7.4 | 7.4               | 7.4 |     |
|              | 12 | 7.4 | 7.4 | 7.4 | 7.4               | 7.4 |     |
|              | 14 | 7.4 | 7.4 | 7.4 | 7.4               | 7.4 |     |
|              | 17 | 7.4 | 7.4 | 7.4 | 7.4               | 7.4 |     |
|              | 19 | 7.4 | 7.4 | 7.4 | 7.4               | 7.4 |     |
|              | 21 | 7.3 | 7.3 | 7.3 | 7.3               | 7.3 |     |
|              | 24 | 7.2 | 7.2 | 7.2 | 7.2               | 7.2 |     |
|              | 26 | 7.4 | 7.4 | 7.4 | 7.4               | 7.4 |     |
|              | 28 |     |     |     |                   |     |     |

|              |    |    |    |    |    |    |    |
|--------------|----|----|----|----|----|----|----|
| Temp<br>(°C) | 0  | 25 | 25 | 25 | 25 | 25 | 25 |
|              | 5  | 23 | 23 | 23 | 23 | 23 | X  |
|              | 7  | 23 | 23 | 24 | 24 | 24 |    |
|              | 10 | 23 | 23 | 23 | 23 | 23 |    |
|              | 12 | 23 | 23 | 23 | 23 | 23 |    |
|              | 14 | 23 | 23 | 23 | 23 | 23 |    |
|              | 17 | 23 | 23 | 23 | 23 | 23 |    |
|              | 19 | 23 | 23 | 23 | 23 | 23 |    |
|              | 21 | 23 | 23 | 23 | 23 | 23 |    |
|              | 24 | 23 | 23 | 23 | 23 | 23 |    |
|              | 26 | 23 | 23 | 23 | 23 | 23 |    |
|              | 28 |    |    |    |    |    |    |

Reviewed By: ALC/ST

Date Reviewed: 2018/10/22  
2018/11/12



Water Type vhw Client: Equilibrium Sample Reference: SP1718-015

**Water Chemistries**

| conc. (mg/L Cl) | Control       | 75 | 150 | 300 | 600 | 1200 |
|-----------------|---------------|----|-----|-----|-----|------|
| day             | Old Solutions |    |     |     |     |      |

pH  
(units)

|    |     |     |     |     |     |     |
|----|-----|-----|-----|-----|-----|-----|
| 5  | 8.2 | 8.3 | 8.3 | 8.3 | 8.4 | 8.4 |
| 7  | 8.6 | 8.5 | 8.5 | 8.5 | 8.5 | 8.5 |
| 10 | 8.5 | 8.6 | 8.6 | 8.6 | 8.5 |     |
| 12 | 8.6 | 8.6 | 8.5 | 8.5 | 8.5 |     |
| 14 | 8.5 | 8.4 | 8.3 | 8.4 | 8.5 |     |
| 17 | 8.3 | 8.3 | 8.4 | 8.4 | 8.4 |     |
| 19 | 8.4 | 8.4 | 8.4 | 8.4 | 8.5 |     |
| 21 | 8.4 | 8.5 | 8.5 | 8.5 | 8.5 |     |
| 24 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 |     |
| 26 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 |     |
| 28 | 8.4 | 8.4 | 8.4 | 8.4 | 8.5 |     |
|    |     |     |     |     |     |     |
|    |     |     |     |     |     |     |
|    |     |     |     |     |     |     |

# 1035  
EC  
(uS/cm)

|    |      |      |      |      |      |      |
|----|------|------|------|------|------|------|
| 5  | 920  | 1134 | 1308 | 1803 | 2630 | 4680 |
| 7  | 955  | 1142 | 1348 | 1823 | 2640 | *    |
| 10 | 949  | 1139 | 1304 | 1847 | 2770 |      |
| 12 | 869  | 1077 | 1274 | 1797 | 2610 |      |
| 14 | 895  | 1092 | 1246 | 1882 | 2670 |      |
| 17 | 991  | 1226 | 1424 | 2200 | 2980 |      |
| 19 | 404* | 1285 | 1480 | 2330 | 3200 |      |
| 21 | 976  | 1181 | 1373 | 1949 | 2870 |      |
| 24 | 981  | 1166 | 1403 | 1860 | 2710 |      |
| 26 | 980  | 1160 | 1372 | 1811 | 2740 |      |
| 28 | 906  | 1192 | 1380 | 1978 | 2870 |      |
|    |      |      |      |      |      |      |
|    |      |      |      |      |      |      |
|    |      |      |      |      |      |      |

\*See daily observations for DO and Temp of old solutions (taken daily)

Reviewed By:

Date Reviewed:

2018/10/22  
-2018/11/6  
M45T



Water Type *shw*

Client:

Equilibrium

Sample Reference:

SP1718-015

**DAILY TEST OBSERVATIONS**

**SURVIVAL**

| conc. (mg/L Cl <sup>-</sup> ) | Control |    |    |    | 75 |    |    |    | 150 |    |    |    | 300 |    |    |    | 600 |    |    |    | 1200 |    |    |    |
|-------------------------------|---------|----|----|----|----|----|----|----|-----|----|----|----|-----|----|----|----|-----|----|----|----|------|----|----|----|
|                               | A       | B  | C  | D  | A  | B  | C  | D  | A   | B  | C  | D  | A   | B  | C  | D  | A   | B  | C  | D  | A    | B  | C  | D  |
| Replicate day                 |         |    |    |    |    |    |    |    |     |    |    |    |     |    |    |    |     |    |    |    |      |    |    |    |
| 1                             | 10      | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10   | 10 | 10 | 10 |
| 2                             | 10      | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10   | 10 | 10 | 10 |
| 3                             | 10      | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10   | 10 | 10 | 10 |
| 4                             | 10      | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10   | 10 | 10 | 10 |
| 5                             | 10      | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10   | 10 | 10 | 10 |
| 6                             | 10      | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10   | 10 | 10 | 10 |
| 7                             | 10      | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10   | 10 | 10 | 10 |
| 8                             | 10      | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10   | 10 | 10 | 10 |
| 9                             | 10      | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10   | 10 | 10 | 10 |
| 10                            | 10      | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10   | 10 | 10 | 10 |
| 11                            | 10      | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10   | 10 | 10 | 10 |
| 12                            | 10      | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10   | 10 | 10 | 10 |
| 13                            | 10      | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10   | 10 | 10 | 10 |
| 14                            | 10      | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10   | 10 | 10 | 10 |
| 15                            | 10      | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10   | 10 | 10 | 10 |
| 16                            | 10      | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10   | 10 | 10 | 10 |
| 17                            | 10      | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10   | 10 | 10 | 10 |
| 18                            | 10      | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10   | 10 | 10 | 10 |
| 19                            | 10      | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10   | 10 | 10 | 10 |
| 20                            | 10      | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10   | 10 | 10 | 10 |
| 21                            | 10      | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10   | 10 | 10 | 10 |
| 22                            | 10      | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10   | 10 | 10 | 10 |
| 23                            | 10      | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10   | 10 | 10 | 10 |
| 24                            | 10      | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10   | 10 | 10 | 10 |
| 25                            | 10      | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10   | 10 | 10 | 10 |
| 26                            | 10      | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10   | 10 | 10 | 10 |
| 27                            | 10      | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10   | 10 | 10 | 10 |
| 28                            | 10      | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10  | 10 | 10 | 10 | 10   | 10 | 10 | 10 |

Reviewed By:

*ALG*

Date Reviewed:

*7-3 very small ones*  
*21811022*  
*21811102*

*PA - don't average.*

*2 very small*

Written by: JP 2018/08/03

Nautilus Environmental (Calgary)

Uncontrolled Document

SP1718-015

*Day 14*  
*x very small in 3000 compared to others*



## DAILY TEST OBSERVATIONS

Life Cycle Stage

| conc. (mg/L Cl <sup>-</sup> ) | Control |   |   |   | 75 |   |   |   | 150 |   |   |   | 300 |   |   |   | 600 |   |   |   | 1200 |   |   |   |
|-------------------------------|---------|---|---|---|----|---|---|---|-----|---|---|---|-----|---|---|---|-----|---|---|---|------|---|---|---|
|                               | A       | B | C | D | A  | B | C | D | A   | B | C | D | A   | B | C | D | A   | B | C | D | A    | B | C | D |
| Replicate day                 |         |   |   |   |    |   |   |   |     |   |   |   |     |   |   |   |     |   |   |   |      |   |   |   |
| 1                             | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 2                             | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 3                             | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 4                             | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 5                             | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 6                             | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 7                             | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 8                             | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 9                             | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 10                            | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 11                            | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 12                            | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 13                            | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 14                            | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 15                            | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 16                            | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 17                            | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 18                            | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 19                            | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 20                            | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 21                            | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 22                            | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 23                            | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 24                            | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 25                            | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 26                            | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 27                            | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |
| 28                            | 2       | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2   | 2 | 2 | 2 | 2    | 2 | 2 | 2 |

N=Nymph PE = Pre-Emergent

\* put in brackets the number of organisms in each stage (ie. 10N, or 9N, 1PE)

Reviewed By:

W15T

Day 24 - 01/05

Date Reviewed: 2/5/02

Day 26 - 75C - one dead in black wing stage

Day 27 - 150A - 1 dead in emergence

Day 28 - 1200A - 1 dead in black wing stage

Day 26 - 01/05 - Dead in black wing stage

Written by: JP 2018/08/03

Nautilus Environmental (Calgary)

Uncontrolled Document

SP1718-015



Water Type SW

Client: Equilibrium

Sample Reference: SP1718-015

## DAILY TEST OBSERVATIONS

DO (%) 80 - 100% saturation

| concentration (mg/L Cl <sup>-</sup> ) | Control |     |     |     | 75  |     |     |     | 150 |     |     |     | 300 |     |     |     | 600 |     |     |     | 1200 |     |     |     |
|---------------------------------------|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|-----|-----|-----|
|                                       | A       | B   | C   | D   | A   | B   | C   | D   | A   | B   | C   | D   | A   | B   | C   | D   | A   | B   | C   | D   | A    | B   | C   | D   |
| Replicate                             |         |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |      |     |     |     |
| day                                   |         |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |      |     |     |     |
| 1                                     | 9.1     | 9.1 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0  | 9.0 | 9.0 | 9.0 |
| 2                                     | 8.4     | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4  | 8.4 | 8.4 | 8.4 |
| 3                                     | 8.4     | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4  | 8.4 | 8.4 | 8.4 |
| 4                                     | 8.4     | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4  | 8.4 | 8.4 | 8.4 |
| 5                                     | 8.4     | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4  | 8.4 | 8.4 | 8.4 |
| 6                                     | 8.4     | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4  | 8.4 | 8.4 | 8.4 |
| 7                                     | 8.4     | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4  | 8.4 | 8.4 | 8.4 |
| 8                                     | 8.4     | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4  | 8.4 | 8.4 | 8.4 |
| 9                                     | 8.4     | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4  | 8.4 | 8.4 | 8.4 |
| 10                                    | 8.4     | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4  | 8.4 | 8.4 | 8.4 |
| 11                                    | 8.4     | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4  | 8.4 | 8.4 | 8.4 |
| 12                                    | 8.4     | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4  | 8.4 | 8.4 | 8.4 |
| 13                                    | 8.4     | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4  | 8.4 | 8.4 | 8.4 |
| 14                                    | 8.4     | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4  | 8.4 | 8.4 | 8.4 |
| 15                                    | 8.4     | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4  | 8.4 | 8.4 | 8.4 |
| 16                                    | 8.4     | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4  | 8.4 | 8.4 | 8.4 |
| 17                                    | 8.4     | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4  | 8.4 | 8.4 | 8.4 |
| 18                                    | 8.4     | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4  | 8.4 | 8.4 | 8.4 |
| 19                                    | 8.4     | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4  | 8.4 | 8.4 | 8.4 |
| 20                                    | 8.4     | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4  | 8.4 | 8.4 | 8.4 |
| 21                                    | 8.4     | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4  | 8.4 | 8.4 | 8.4 |
| 22                                    | 8.4     | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4  | 8.4 | 8.4 | 8.4 |
| 23                                    | 8.4     | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4  | 8.4 | 8.4 | 8.4 |
| 24                                    | 8.4     | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4  | 8.4 | 8.4 | 8.4 |
| 25                                    | 8.4     | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4  | 8.4 | 8.4 | 8.4 |
| 26                                    | 8.4     | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4  | 8.4 | 8.4 | 8.4 |
| 27                                    | 8.4     | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4  | 8.4 | 8.4 | 8.4 |
| 28                                    | 8.4     | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4  | 8.4 | 8.4 | 8.4 |

Days  
1200  
A B C D  
7.7 7.7 7.7 7.7

Reviewed By: BLL

Date Reviewed: 20181102-20181102

Written by: JP 2018/08/03  
 + slightly acclimated.  
 Dec 27 - 600 - direct

Nautilus Environmental (Calgary)

Uncontrolled Document  
 SP1718-015



Water Type

*vhw*

Client: Equilibrium

Sample Reference: SP1718-015

**DAILY TEST OBSERVATIONS**

Temperature (°C) - 24 +/- 1

| conc. (mg/L Cl <sup>-</sup> )<br>Replicate<br>day | Control |   |   |   | 75 |   |   |   | 150 |   |   |   | 300 |   |   |   | 600 |   |   |   | 1200 |   |   |   |
|---------------------------------------------------|---------|---|---|---|----|---|---|---|-----|---|---|---|-----|---|---|---|-----|---|---|---|------|---|---|---|
|                                                   | A       | B | C | D | A  | B | C | D | A   | B | C | D | A   | B | C | D | A   | B | C | D | A    | B | C | D |
| 1                                                 | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |   |   |   | 23   |   |   |   |
| 2                                                 | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |   |   |   | 23   |   |   |   |
| 3                                                 | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |   |   |   | 23   |   |   |   |
| 4                                                 | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |   |   |   | 23   |   |   |   |
| 5                                                 | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |   |   |   | 23   |   |   |   |
| 6                                                 | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |   |   |   | 23   |   |   |   |
| 7                                                 | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |   |   |   | 23   |   |   |   |
| 8                                                 | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |   |   |   | 23   |   |   |   |
| 9                                                 | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |   |   |   | 23   |   |   |   |
| 10                                                | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |   |   |   | 23   |   |   |   |
| 11                                                | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |   |   |   | 23   |   |   |   |
| 12                                                | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |   |   |   | 23   |   |   |   |
| 13                                                | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |   |   |   | 23   |   |   |   |
| 14                                                | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |   |   |   | 23   |   |   |   |
| 15                                                | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |   |   |   | 23   |   |   |   |
| 16                                                | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |   |   |   | 23   |   |   |   |
| 17                                                | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |   |   |   | 23   |   |   |   |
| 18                                                | 24      |   |   |   | 24 |   |   |   | 24  |   |   |   | 24  |   |   |   | 24  |   |   |   | 24   |   |   |   |
| 19                                                | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |   |   |   | 23   |   |   |   |
| 20                                                | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |   |   |   | 23   |   |   |   |
| 21                                                | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |   |   |   | 23   |   |   |   |
| 22                                                | 24      |   |   |   | 24 |   |   |   | 24  |   |   |   | 24  |   |   |   | 24  |   |   |   | 24   |   |   |   |
| 23                                                | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |   |   |   | 23   |   |   |   |
| 24                                                | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |   |   |   | 23   |   |   |   |
| 25                                                | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |   |   |   | 23   |   |   |   |
| 26                                                | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |   |   |   | 23   |   |   |   |
| 27                                                | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |   |   |   | 23   |   |   |   |
| 28                                                | 23      |   |   |   | 23 |   |   |   | 23  |   |   |   | 23  |   |   |   | 23  |   |   |   | 23   |   |   |   |

\* attach  
copy to  
in 1200  
w/c

Date Reviewed: 2018/08/03  
Reviewed By: *vhw*



comment summary

Client: \_\_\_\_\_  
 Client #: \_\_\_\_\_

Sample #: VHJ  
 Test #: \_\_\_\_\_

Date: \_\_\_\_\_  
 Initials: \_\_\_\_\_

Day 5 - transferred to IL jar 4

Day 19 - very small in 300 + 600 mg compared to others

Day 23 - 7SB → didn't emerge

Day 24 - CT-C → died as PE, didn't emerge

CTD → died as PE, didn't emerge

7SA → died as PE, didn't emerge

Day 25 - 7SD → T

Day 26 - CTLB → died as PE, didn't emerge

- 7SC → died as PE, didn't emerge

Day 27 - 1SCA → 1 died emerging

Day 28 - 7SA → 1 died emerging

- 1SCA → 1 died as PE, didn't emerge

1SCB → 1 - 1SCP - 1 died as PE

- 1SOC → 1 died as PE

- 300C → 2 very small, 300D - 3 very small

Day 29 - 7SB → 1 died emerging



Concentration:

VHW-12

Day:

20

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 5                   | 0              | 0                          | /                           | 0                     | 5                       | 5              |
| B     | 5                   | 0              | 0                          | /                           | 0                     | 5                       | 5              |
| C     | 5                   | 0              | 0                          | /                           | 0                     | 5                       | 5              |
| D     | 5                   | 0              | 0                          | /                           | 0                     | 5                       | 5              |

Day:

21

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 5                   | 0              | 0                          | 0                           | 0                     | 5                       | 5              |
| B     | 5                   | 0              | 0                          | 0                           | 0                     | 5                       | 5              |
| C     | 5                   | 0              | 0                          | 0                           | 0                     | 5                       | 5              |
| D     | 5                   | 0              | 0                          | 0                           | 0                     | 5                       | 5              |

Day:

22

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 4                   | 2              | 2                          | 0                           | 0                     | 2                       | 4              |
| B     | 5                   | 0              | 0                          | 0                           | 0                     | 5                       | 5              |
| C     | 5                   | 0              | 0                          | 0                           | 0                     | 5                       | 5              |
| D     | 5                   | 0              | 0                          | 0                           | 0                     | 5                       | 5              |

Day:

23

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 2                   | 0              | 0                          | 2                           | 2                     | 2                       | 4              |
| B     | 5                   | 0              | 0                          | 0                           | 1                     | 5                       | 6              |
| C     | 5                   | 2              | 2                          | 0                           | 1                     | 3                       | 6              |
| D     | 4                   | 1              | 1                          | 0                           | 0                     | 3                       | 4              |

Day:

24

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 2                   | 2              | 2                          | 0                           | 2                     | 0                       | 4              |
| B     | 5                   | 1              | 1                          | 0                           | 1                     | 0                       | 6              |
| C     | 3                   | 1              | 1                          | 1                           | 2                     | 2                       | 5              |
| D     | 2                   | 1              | 1                          | 0                           | 0                     | 1                       | 2              |

Concentration:

VHW-CD

Day:

25

Initials:

/

Date:

/

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 1                   | 1              | 1                          | 2                           | 3                     | 0                       | 4              |
| B     | 4                   | 1              | 1                          | 1                           | 2                     | 3                       | 6              |
| C     | 2                   | 0              | 0                          | 1                           | 3                     | 1                       | 5              |
| D     | 4                   | 0              | 0                          | 1                           | 1                     | 1                       | 2              |

Day:

26

Initials:

/

Date:

/

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 1                   | 1              | 1                          | 1                           | 4                     | 1                       | 4              |
| B     | 3                   | 1              | 1                          | 0                           | 2                     | 2                       | 5              |
| C     | 1                   | 0              | 0                          | 0                           | 4                     | 1                       | 3              |
| D     | 1                   | 0              | 0                          | 0                           | 1                     | 1                       | 2              |

Day:

27

Initials:

/

Date:

/

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 2                   | 1              | 1                          | 1                           | 4                     | 1                       | 4              |
| B     | 2                   | 1              | 1                          | 1                           | 3                     | 1                       | 5              |
| C     | 1                   | 0              | 0                          | 0                           | 4                     | 1                       | 3              |
| D     | 1                   | 0              | 0                          | 0                           | 1                     | 1                       | 2              |

Day:

28

Initials:

/

Date:

/

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 1                   | 0              | 0                          | 1                           | 4                     | 1                       | 4              |
| B     | 1                   | 0              | 0                          | 1                           | 4                     | 1                       | 5              |
| C     | 1                   | 0              | 0                          | 0                           | 4                     | 1                       | 3              |
| D     | 1                   | 0              | 0                          | 0                           | 1                     | 1                       | 2              |

Day:

29

Initials:

/

Date:

/

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | /                   | /              | /                          | 0                           | 4                     | /                       | 4              |
| B     | /                   | /              | /                          | 0                           | 4                     | /                       | 5 (imago)      |
| C     | /                   | /              | /                          | 0                           | 4                     | /                       | 5 (imago)      |
| D     | /                   | /              | /                          | 0                           | 1                     | /                       | 2 (imago)      |



Concentration:

VHW-75

Day:

20

Initials:

/

Date:

/

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 7                   | 0              | 0                          | /                           | 0                     | 7                       | 7              |
| B     | 6                   | 0              | 0                          | /                           | 0                     | 6                       | 6              |
| C     | 5                   | 0              | 0                          | /                           | 0                     | 5                       | 5              |
| D     | 7                   | 0              | 0                          | /                           | 0                     | 7                       | 7              |

Day:

21

Initials:

/

Date:

/

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 7                   | 0              | 0                          | 0                           | 0                     | 6                       | 7              |
| B     | 6                   | 0              | 0                          | 0                           | 0                     | 6                       | 6              |
| C     | 5                   | 0              | 0                          | 0                           | 0                     | 5                       | 5              |
| D     | 7                   | 0              | 0                          | 0                           | 0                     | 7                       | 7              |

Day:

22

Initials:

/

Date:

/

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 5                   | 0              | 0                          | 0                           | 0                     | 5                       | 6              |
| B     | 6                   | 2              | 2                          | 0                           | 0                     | 5                       | 6              |
| C     | 5                   | 0              | 0                          | 0                           | 0                     | 5                       | 5              |
| D     | 7                   | 0              | 0                          | 0                           | 0                     | 7                       | 7              |

Day:

23

Initials:

/

Date:

/

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 5                   | 2              | 2                          | 0                           | 1                     | 3                       | 6              |
| B     | 4                   | 1              | 1                          | 0                           | 1                     | 3                       | 5              |
| C     | 5                   | 1              | 1                          | 0                           | 0                     | 5                       | 5              |
| D     | 6                   | 1              | 1                          | 0                           | 0                     | 5                       | 6              |

Day:

24

Initials:

/

Date:

/

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 3                   | 0              | 0                          | 1                           | 2                     | 3                       | 5              |
| B     | 3                   | 0              | 0                          | 1                           | 2                     | 3                       | 5              |
| C     | 4                   | 1              | 1                          | 1                           | 1                     | 3                       | 5              |
| D     | 5                   | 2              | 2                          | 1                           | 1                     | 3                       | 6              |

Concentration:

VHW-75

Day:

25

Initials:

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Date:

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| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 3                   | 1              | 1                          | 0                           | 2                     | 2                       | 5              |
| B     | 3                   | 0              | 0                          | 0                           | 2                     | 3                       | 3              |
| C     | 3                   | 2              | 2                          | 1                           | 2                     | 1                       | 6              |
| D     | 3                   | 1              | 1                          | 2                           | 3                     | 2                       | 6              |

Day:

26

Initials:

—

Date:

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| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 2                   | 0              | 0                          | 1                           | 3                     | 2                       | 5              |
| B     | 3                   | 0              | 0                          | 0                           | 2                     | 3                       | 3              |
| C     | 1                   | 0              | 0                          | 1                           | 3                     | 1                       | 4              |
| D     | 2                   | 0              | 0                          | 1                           | 4                     | 2                       | 6              |

Day:

27

Initials:

—

Date:

—

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 2                   | 1              | 1                          | 0                           | 3                     | 1                       | 5              |
| B     | 3                   | 0              | 0                          | 0                           | 2                     | 3                       | 3              |
| C     | 1                   | 0              | 0                          | 0                           | 3                     | 1                       | 4              |
| D     | 2                   | 0              | 0                          | 0                           | 4                     | 2                       | 6              |

Day:

28

Initials:

—

Date:

—

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 1                   | 1              | 1                          | 0                           | 3                     | 0                       | 4              |
| B     | 3                   | 1              | 1                          | 0                           | 2                     | 2                       | 5              |
| C     | 1                   | 1              | 1                          | 0                           | 3                     | 0                       | 4              |
| D     | 2                   | 1              | 1                          | 0                           | 4                     | 1                       | 6              |

Day:

29

Initials:

—

Date:

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| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | /                   | /              | /                          | 0                           | 3                     | /                       | 3              |
| B     | /                   | /              | /                          | 0                           | 3                     | /                       | 3              |
| C     | /                   | /              | /                          | 1                           | 4                     | /                       | 4              |
| D     | /                   | /              | /                          | 1                           | 5                     | /                       | 6              |

(nymph)

(nymph)



Concentration:

VHUV-ISO

Day:

20

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 6                   | 0              | 0                          | /                           | 0                     | 6                       | 6              |
| B     | 6                   | 0              | 0                          |                             | 0                     | 6                       | 6              |
| C     | 7                   | 0              | 0                          |                             | 0                     | 7                       | 7              |
| D     | 7                   | 0              | 0                          |                             | 0                     | 7                       | 7              |

Day:

21

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 6                   | 0              | 0                          | 0                           | 0                     | 6                       | 6              |
| B     | 6                   | 0              | 0                          | 0                           | 0                     | 6                       | 6              |
| C     | 7                   | 0              | 0                          | 0                           | 0                     | 7                       | 7              |
| D     | 7                   | 0              | 0                          | 0                           | 0                     | 7                       | 7              |

Day:

22

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 6                   | 0              | 0                          | 0                           | 0                     | 6                       | 6              |
| B     | 6                   | 0              | 0                          | 0                           | 0                     | 6                       | 6              |
| C     | 7                   | 0              | 0                          | 0                           | 0                     | 7                       | 7              |
| D     | 7                   | 0              | 0                          | 0                           | 0                     | 7                       | 7              |

Day:

23

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 8                   | 1              | 1                          | 0                           | 0                     | 5                       | 6              |
| B     | 5                   | 0              | 0                          | 0                           | 0                     | 5                       | 6              |
| C     | 7                   | 0              | 0                          | 0                           | 0                     | 7                       | 7              |
| D     | 7                   | 0              | 0                          | 0                           | 0                     | 7                       | 7              |

Day:

24

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 5                   | 0              | 0                          | 1                           | 1                     | 5                       | 6              |
| B     | 5                   | 0              | 0                          | 0                           | 0                     | 5                       | 6              |
| C     | 6                   | 0              | 0                          | 0                           | 0                     | 6                       | 6              |
| D     | 7                   | 0              | 0                          | 0                           | 0                     | 7                       | 7              |

Concentration:

VHW 750

Day:

25

Initials:

✓

Date:

✓

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 5                   | 1              | 1                          | 0                           | 1                     | 4                       | 6              |
| B     | 5                   | 1              | 1                          | 0                           | 1                     | 4                       | 6              |
| C     | 6                   | 1              | 1                          | 0                           | 0                     | 5                       | 6              |
| D     | 7                   | 1              | 1                          | 0                           | 0                     | 6                       | 7              |

Day:

26

Initials:

✓

Date:

✓

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 4                   | 2              | 2                          | 1                           | 2                     | 2                       | 6              |
| B     | 4                   | 0              | 0                          | 1                           | 2                     | 4                       | 6              |
| C     | 5                   | 0              | 0                          | 1                           | 1                     | 5                       | 6              |
| D     | 6                   | 1              | 1                          | 1                           | 1                     | 5                       | 7              |

Day:

27

Initials:

✓

Date:

✓

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 2                   | 0              | 0                          | 1                           | 3                     | 1                       | 5              |
| B     | 2                   | 0              | 0                          | 0                           | 2                     | 4                       | 6              |
| C     | 3                   | 1              | 0                          | 0                           | 1                     | 4                       | 6              |
| D     | 5                   | 1              | 1                          | 1                           | 2                     | 4                       | 7              |

Day:

28

Initials:

✓

Date:

✓

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 1                   | 0              | 0                          | 0                           | 3                     | 1                       | 4              |
| B     | 1                   | 1              | 0                          | 0                           | 2                     | 3                       | 6              |
| C     | 4                   | 0              | 0                          | 0                           | 1                     | 4                       | 6              |
| D     | 4                   | 0              | 0                          | 0                           | 2                     | 4                       | 6              |

Day:

29

Initials:

✓

Date:

✓

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | /                   | /              | /                          | 0                           | 3                     | /                       | 4 (1 nymph)    |
| B     | /                   | /              | /                          | 1                           | 3                     | /                       | 6 (3 nymph)    |
| C     | /                   | /              | /                          | 0                           | 2                     | /                       | 5 (4 nymph)    |
| D     | /                   | /              | /                          | 0                           | 2                     | /                       | 6 (4 nymph)    |



Concentration:

VHW-300

Day:

20

Initials:

✓

Date:

✓

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 7                   | 0              | 0                          | /                           | 0                     | 7                       | 7              |
| B     | 6                   | 0              | 0                          | /                           | 0                     | 6                       | 6              |
| C     | 7                   | 0              | 0                          | /                           | 0                     | 7                       | 7              |
| D     | 4                   | 0              | 0                          | /                           | 0                     | 4                       | 4              |

Day:

21

Initials:

✓

Date:

✓

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 6                   | 1              | 1                          | 0                           | 0                     | 5                       | 6              |
| B     | 6                   | 0              | 0                          | 0                           | 0                     | 6                       | 6              |
| C     | 8                   | 0              | 0                          | 0                           | 0                     | 8                       | 8              |
| D     | 4                   | 0              | 0                          | 0                           | 0                     | 4                       | 4              |

Day:

22

Initials:

✓

Date:

✓

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 5                   | 0              | 0                          | 1                           | 1                     | 5                       | 6              |
| B     | 6                   | 0              | 0                          | 1                           | 1                     | 6                       | 6              |
| C     | 7                   | 0              | 0                          | 0                           | 0                     | 7                       | 7              |
| D     | 4                   | 0              | 0                          | 0                           | 0                     | 4                       | 4              |

Day:

23

Initials:

✓

Date:

✓

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 5                   | 0              | 0                          | 0                           | 1                     | 5                       | 6              |
| B     | 6                   | 0              | 0                          | 0                           | 1                     | 6                       | 6              |
| C     | 7                   | 0              | 0                          | 0                           | 0                     | 7                       | 7              |
| D     | 4                   | 0              | 0                          | 0                           | 0                     | 4                       | 4              |

Day:

24

Initials:

✓

Date:

✓

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 5                   | 0              | 0                          | 0                           | 1                     | 5                       | 6              |
| B     | 5                   | 0              | 0                          | 0                           | 1                     | 5                       | 6              |
| C     | 7                   | 0              | 0                          | 0                           | 0                     | 7                       | 7              |
| D     | 2                   | 0              | 0                          | 0                           | 0                     | 2                       | 2              |

Concentration:

VHWN-300

Day:

25

Initials:

✓

Date:

✓

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 5                   | ○              | ○                          | ○                           | 1                     | 5                       | 6              |
| B     | 5                   | ○              | ○                          | ○                           | 1                     | 5                       | 5              |
| C     | 7                   | ↓              | ↓                          | ↓                           | 8                     | 7                       | 7              |
| D     | 2                   | ↓              | ↓                          | ↓                           | 8                     | 2                       | 2              |

Day:

26

Initials:

✓

Date:

✓

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 5                   | ○              | ○                          | ○                           | 1                     | 5                       | 6              |
| B     | 5                   | ○              | ○                          | ○                           | 1                     | 5                       | 5              |
| C     | 7                   | ↓              | ↓                          | ↓                           | 8                     | 7                       | 7              |
| D     | 2                   | ↓              | ↓                          | ↓                           | 8                     | 2                       | 2              |

Day:

27

Initials:

✓

Date:

✓

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 5                   | ○              | ○                          | ○                           | 1                     | 5                       | 6              |
| B     | 5                   | ○              | ○                          | ○                           | 1                     | 5                       | 5              |
| C     | 7                   | ↓              | ↓                          | ↓                           | 8                     | 7                       | 7              |
| D     | 2                   | ↓              | ↓                          | ↓                           | 8                     | 2                       | 2              |

Day:

28

Initials:

✓

Date:

✓

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 5                   | ○              | ○                          | ○                           | 1                     | 5                       | 6              |
| B     | 5                   | ○              | ○                          | ○                           | 1                     | 5                       | 5              |
| C     | 7                   | ↓              | ↓                          | ↓                           | 8                     | 7                       | 7              |
| D     | 2                   | ↓              | ↓                          | ↓                           | 8                     | 2                       | 2              |

Day:

29

Initials:

✓

Date:

✓

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | /                   | /              | /                          | ○                           | 1                     | -                       | 6 (S nymph)    |
| B     | /                   | /              | /                          | ○                           | 1                     | -                       | 5              |
| C     | /                   | /              | /                          | ↓                           | 8                     | -                       | 7              |
| D     | /                   | /              | /                          | ↓                           | 8                     | -                       | 2              |



Concentration:

VHW 600

Day:

20

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 4                   | 0              | 0                          |                             | 0                     | 4                       | 4              |
| B     | 4                   | 0              | 0                          |                             | 0                     | 4                       | 4              |
| C     | 4                   | 0              | 0                          |                             | 0                     | 4                       | 4              |
| D     | 1                   | 0              | 0                          |                             | 0                     | 1                       | 1              |

Day:

21

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 4                   | 0              | 0                          |                             | 0                     | 4                       | 4              |
| B     | 3                   | 0              | 0                          |                             | 0                     | 3                       | 3              |
| C     | 3                   | 0              | 0                          |                             | 0                     | 3                       | 3              |
| D     | 1                   | 0              | 0                          |                             | 0                     | 1                       | 1              |

Day:

22

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 4                   | 0              | 0                          |                             | 0                     | 4                       | 4              |
| B     | 3                   | 0              | 0                          |                             | 0                     | 3                       | 3              |
| C     | 3                   | 0              | 0                          |                             | 0                     | 3                       | 3              |
| D     | 1                   | 0              | 0                          |                             | 0                     | 1                       | 1              |

Day:

23

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 3                   | 0              | 0                          |                             | 0                     | 3                       | 3              |
| B     | 2                   | 0              | 0                          |                             | 0                     | 2                       | 2              |
| C     | 2                   | 0              | 0                          |                             | 0                     | 2                       | 2              |
| D     | 1                   | 0              | 0                          |                             | 0                     | 1                       | 1              |

Day:

24

Initials:

Date:

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 3                   | 0              | 0                          |                             | 0                     | 3                       | 3              |
| B     | 2                   | 0              | 0                          |                             | 0                     | 2                       | 2              |
| C     | 2                   | 0              | 0                          |                             | 0                     | 2                       | 2              |
| D     | 1                   | 0              | 0                          |                             | 0                     | 1                       | 1              |

Concentration: VHw-6000

 Day: 25 Initials: \_\_\_\_\_ Date: \_\_\_\_\_

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 3                   | 0              | 0                          |                             | 0                     | 3                       | 3              |
| B     | 2                   | 0              | 0                          |                             | 0                     | 2                       | 2              |
| C     | 2                   | 0              | 0                          |                             | 0                     | 2                       | 2              |
| D     | 1                   | 0              | 0                          |                             | 0                     | 1                       | 1              |

 Day: 26 Initials: \_\_\_\_\_ Date: \_\_\_\_\_

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 3                   | 0              | 0                          |                             | 0                     | 3                       | 3              |
| B     | 2                   | 0              | 0                          |                             | 0                     | 2                       | 2              |
| C     | 2                   | 0              | 0                          |                             | 0                     | 2                       | 2              |
| D     | 1                   | 0              | 0                          |                             | 0                     | 1                       | 1              |

 Day: 27 Initials: \_\_\_\_\_ Date: \_\_\_\_\_

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 3                   | 0              | 0                          |                             | 0                     | 3                       | 3              |
| B     | 2                   | 0              | 0                          |                             | 0                     | 2                       | 2              |
| C     | 2                   | 0              | 0                          |                             | 0                     | 2                       | 2              |
| D     | 1                   | 0              | 0                          |                             | 0                     | 1                       | 1              |

 Day: 28 Initials: \_\_\_\_\_ Date: \_\_\_\_\_

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     | 3                   | 0              | 0                          |                             | 0                     | 3                       | 3              |
| B     | 2                   | 0              | 0                          |                             | 0                     | 2                       | 2              |
| C     | 1                   | 0              | 0                          |                             | 0                     | 1                       | 1              |
| D     | 1                   | 0              | 0                          |                             | 0                     | 1                       | 1              |

 Day: 29 Initials: \_\_\_\_\_ Date: \_\_\_\_\_

| Jar # | Nymphs Alive in Jar | # Pre-Emergent | # Transferred to Imago Jar | # Transferred to Weigh Vial | Total # in Weigh Vial | # Remaining in Test Jar | Total Survival |
|-------|---------------------|----------------|----------------------------|-----------------------------|-----------------------|-------------------------|----------------|
| A     |                     |                |                            |                             | 0                     |                         | 3              |
| B     |                     |                |                            |                             |                       |                         | 2              |
| C     |                     |                |                            |                             |                       |                         | 1              |
| D     |                     |                |                            |                             |                       |                         | 1              |

all nymph



# Organism Weights Bench Sheet

Client NAU 104 Sample SP1718-015 Organism MA Batch ✓

VHW

| Item Weighed          | Date       | Initials | Balance* |
|-----------------------|------------|----------|----------|
| dried pan             | 2018/09/19 | SV       | NAU 1    |
| dried pan + organisms | 2018/09/19 | NC       | NAU 1    |

Initial Weight (mg):  
Final Weight (mg):

\* same balance must be used for initial and final weights  
\* for FM/HA/CT, must use scale with 0.01 mg accuracy

| Replicate | Initial | Final |
|-----------|---------|-------|
| a         | 991.02  | ✓     |
| b         | 1004.73 | ✓     |
| c         | 1001.40 | ✓     |
| d         | 991.48  | ✓     |
| e         |         |       |

| Initial | Final  |
|---------|--------|
| 991.56  | 993.84 |
| 993.24  | 994.78 |
| 986.86  | 989.02 |
| 989.53  | 990.12 |

| Initial | Final |
|---------|-------|
| 986.88  | ✓     |
| 1001.50 | ✓     |
| 994.31  | ✓     |
| 985.41  | ✓     |

| Initial | Final   |
|---------|---------|
| 993.17  | 995.20  |
| 1004.63 | 1004.01 |
| 990.25  | 992.18  |
| 996.67  | 998.63  |

| Initial | Final |
|---------|-------|
| 996.87  | ✓     |
| 991.17  | ✓     |
| 984.33  | ✓     |
| 990.53  | ✓     |

| Initial | Final  |
|---------|--------|
| 996.89  | 998.80 |
| 990.61  | 992.19 |
| 984.78  | 986.06 |
| 990.75  | 991.83 |

Concentration

| Initial | Final |
|---------|-------|
| 983.93  | ✓     |
| 997.14  | ✓     |
| 989.64  | ✓     |
| 1003.42 | ✓     |

| Initial | Final  |
|---------|--------|
| 991.68  | 992.63 |
| 989.21  | ✓      |
| 993.24  | ✓      |
| 995.32  | ✓      |

| Initial | Final |
|---------|-------|
| 993.87  | ✓     |
| 990.5   | ✓     |
| 990.03  | ✓     |
| 1001.89 | ✓     |
| 991.17  | ✓     |

| Initial | Final |
|---------|-------|
| 991.97  | ✓     |
| 994.23  | ✓     |
| 990.35  | ✓     |
| 1004.84 | ✓     |

| Initial | Final |
|---------|-------|
|         |       |
|         |       |
|         |       |

| Initial | Final |
|---------|-------|
|         |       |
|         |       |
|         |       |

## Balance Calibration Check:

first pan weighed: Initial Final  
weight of first pan: 991.02 991.02  
first pan after all other pans weighed: 990.98 990.98

% difference < 5%: Yes/No Yes

$$\% \text{ difference} = \frac{(\text{initial weight} - \text{reweight})}{(\text{initial weight} + \text{reweight}) / 2} \times 100\%$$

Test Validity Met: Yes/No/NA

Results are Logical\*\*: Yes/No

\*\* no negative numbers, consistent values across replicates

If "no" is circled for any parameter, notify Lab Supervisor/  
QA Group to determine appropriate action

Reviewed By: \_\_\_\_\_ Date Reviewed: \_\_\_\_\_

## CETIS Analytical Report

Report Date: 04 Dec-18 08:55 (p 1 of 2)  
 Test Code/ID: SP1718-015 VHW / 14-9088-9246

| Ephemeroptera (Mayfly) 28-d Test |  |                                            |  | Nautilus Environmental Calgary    |  |             |  |
|----------------------------------|--|--------------------------------------------|--|-----------------------------------|--|-------------|--|
| <b>Analysis ID:</b> 00-5027-5782 |  | <b>Endpoint:</b> 28d Survival Rate         |  | <b>CETIS Version:</b> CETISv1.9.4 |  |             |  |
| <b>Analyzed:</b> 04 Dec-18 8:55  |  | <b>Analysis:</b> Untrimmed Spearman-Kärber |  | <b>Status Level:</b> 1            |  |             |  |
| <b>Batch ID:</b> 19-8241-5883    |  | <b>Test Type:</b> Growth-Survival (7d)     |  | <b>Analyst:</b> Madison Lehti     |  |             |  |
| <b>Start Date:</b> 31 Aug-18     |  | <b>Protocol:</b> Not Applicable            |  | <b>Diluent:</b>                   |  |             |  |
| <b>Ending Date:</b> 28 Sep-18    |  | <b>Species:</b> Ephemeroptera              |  | <b>Brine:</b>                     |  |             |  |
| <b>Test Length:</b> 28d 0h       |  | <b>Taxon:</b>                              |  | <b>Source:</b>                    |  | <b>Age:</b> |  |
| <b>Sample ID:</b> 05-0251-6583   |  | <b>Code:</b> SP1718-015 VHW                |  | <b>Project:</b>                   |  |             |  |
| <b>Sample Date:</b> 17 Aug-18    |  | <b>Material:</b> chloride                  |  | <b>Source:</b> Equilibrium        |  |             |  |
| <b>Receipt Date:</b> 17 Aug-18   |  | <b>CAS (PC):</b>                           |  | <b>Station:</b> na                |  |             |  |
| <b>Sample Age:</b> 14d 0h        |  | <b>Client:</b> Equilibrium                 |  |                                   |  |             |  |

| Spearman-Kärber Estimates |           |       |       |         |      |         |         |
|---------------------------|-----------|-------|-------|---------|------|---------|---------|
| Threshold Option          | Threshold | Trim  | Mu    | Sigma   | LC50 | 95% LCL | 95% UCL |
| Control Threshold         | 0.6       | 0.00% | 2.769 | 0.02673 | 587  | 519     | 663.9   |

| Residual Analysis |                           |           |          |         |                                   |  |
|-------------------|---------------------------|-----------|----------|---------|-----------------------------------|--|
| Attribute         | Method                    | Test Stat | Critical | P-Value | Decision(α:5%)                    |  |
| Extreme Value     | Grubbs Extreme Value Test | 1.953     | 2.802    | 1.0000  | No Outliers Detected              |  |
| Control Trend     | Mann-Kendall Trend Test   | 1.953     |          | 0.7391  | Non-Significant Trend in Controls |  |

| 7d Survival Rate Summary |      |       | Calculated Variate(A/B) |        |        |         |        |         |       | Isotonic Variate |         |
|--------------------------|------|-------|-------------------------|--------|--------|---------|--------|---------|-------|------------------|---------|
| Conc-mg/L                | Code | Count | Mean                    | Min    | Max    | Std Dev | CV%    | %Effect | A/B   | Mean             | %Effect |
| 8.66                     | N    | 4     | 0.4000                  | 0.2000 | 0.5000 | 0.1414  | 35.36% | 0.0%    | 16/40 | 0.4417           | 0.0%    |
| 81.57                    |      | 4     | 0.4000                  | 0.2000 | 0.5000 | 0.1414  | 35.36% | 0.0%    | 16/40 | 0.4417           | 0.0%    |
| 165.67                   |      | 4     | 0.5250                  | 0.4000 | 0.6000 | 0.0957  | 18.24% | -31.25% | 21/40 | 0.4417           | 0.0%    |
| 343.67                   |      | 4     | 0.4000                  | 0.2000 | 0.5000 | 0.1414  | 35.36% | 0.0%    | 16/40 | 0.4              | 9.43%   |
| 668.33                   |      | 4     | 0.1750                  | 0.1000 | 0.3000 | 0.0957  | 54.71% | 56.25%  | 7/40  | 0.175            | 60.38%  |
| 1333.33                  |      | 4     | 0.0000                  | 0.0000 | 0.0000 | 0.0000  |        | 100.0%  | 0/40  | 0                | 100.0%  |

| 7d Survival Rate Detail |      |        |        |        |        |
|-------------------------|------|--------|--------|--------|--------|
| Conc-mg/L               | Code | Rep 1  | Rep 2  | Rep 3  | Rep 4  |
| 8.66                    | N    | 0.4000 | 0.5000 | 0.5000 | 0.2000 |
| 81.57                   |      | 0.4000 | 0.5000 | 0.5000 | 0.2000 |
| 165.67                  |      | 0.4000 | 0.6000 | 0.5000 | 0.6000 |
| 343.67                  |      | 0.4000 | 0.5000 | 0.5000 | 0.2000 |
| 668.33                  |      | 0.3000 | 0.2000 | 0.1000 | 0.1000 |
| 1333.33                 |      | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

| 7d Survival Rate Binomials |      |       |       |       |       |
|----------------------------|------|-------|-------|-------|-------|
| Conc-mg/L                  | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 |
| 8.66                       | N    | 4/10  | 5/10  | 5/10  | 2/10  |
| 81.57                      |      | 4/10  | 5/10  | 5/10  | 2/10  |
| 165.67                     |      | 4/10  | 6/10  | 5/10  | 6/10  |
| 343.67                     |      | 4/10  | 5/10  | 5/10  | 2/10  |
| 668.33                     |      | 3/10  | 2/10  | 1/10  | 1/10  |
| 1333.33                    |      | 0/10  | 0/10  | 0/10  | 0/10  |

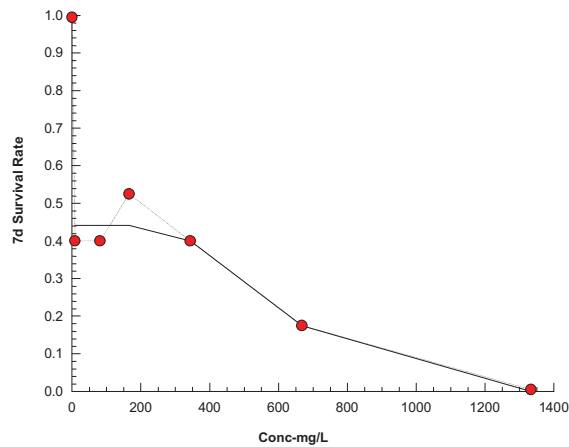


CETIS Analytical Report

Report Date: 04 Dec-18 08:55 (p 2 of 2)  
Test Code/ID: SP1718-015 VHW / 14-9088-9246

| Ephemeroptera (Mayfly) 28-d Test |                | Nautilus Environmental Calgary |                           |
|----------------------------------|----------------|--------------------------------|---------------------------|
| Analysis ID:                     | 00-5027-5782   | Endpoint:                      | 28d Survival Rate         |
| Analized:                        | 04 Dec-18 8:55 | Analysis:                      | Untrimmed Spearman-Kärber |
|                                  |                | CETIS Version:                 | CETISv1.9.4               |
|                                  |                | Status Level:                  | 1                         |

Graphics



## CETIS Analytical Report

Report Date: 12 Dec-18 16:28 (p 1 of 3)  
Test Code/ID: SP1718-015 VHW / 14-9088-9246

| Ephemeroptera (Mayfly) 28-d Test |                 |            |                         | Nautilus Environmental Calgary |               |
|----------------------------------|-----------------|------------|-------------------------|--------------------------------|---------------|
| Analysis ID:                     | 19-1846-4944    | Endpoint:  | 28d Emergence Rate      | CETIS Version:                 | CETISv1.9.4   |
| Analyzed:                        | 12 Dec-18 16:28 | Analysis:  | Linear Regression (GLM) | Status Level:                  | 1             |
| Batch ID:                        | 19-8241-5883    | Test Type: | Growth-Survival (7d)    | Analyst:                       | Madison Lehti |
| Start Date:                      | 31 Aug-18       | Protocol:  | Not Applicable          | Diluent:                       |               |
| Ending Date:                     | 28 Sep-18       | Species:   | Ephemeroptera           | Brine:                         |               |
| Test Length:                     | 28d 0h          | Taxon:     |                         | Source:                        | Age:          |
| Sample ID:                       | 05-0251-6583    | Code:      | SP1718-015 VHW          | Project:                       |               |
| Sample Date:                     | 17 Aug-18       | Material:  | chloride                | Source:                        | Equilibrium   |
| Receipt Date:                    | 17 Aug-18       | CAS (PC):  |                         | Station:                       | na            |
| Sample Age:                      | 14d 0h          | Client:    | Equilibrium             |                                |               |

## Linear Regression Options

| Model Name | Link Function                | Threshold Option  | Thresh | Optimized | Pooled | Het Corr | Weighted |
|------------|------------------------------|-------------------|--------|-----------|--------|----------|----------|
| Log-Angle  | $\eta = \arcsin[\sqrt{\pi}]$ | Control Threshold | 0.675  | Yes       | No     | No       | Yes      |

## Regression Summary

| Iters | LL     | AICc  | BIC   | Mu    | Sigma | Adj R2 | F Stat | Critical | P-Value | Decision( $\alpha$ :5%)     |
|-------|--------|-------|-------|-------|-------|--------|--------|----------|---------|-----------------------------|
| 8     | -20.49 | 48.19 | 50.52 | 1.912 |       | 0.7322 | 0.1716 | 3.16     | 0.9142  | Non-Significant Lack of Fit |

## Point Estimates

| Level | mg/L  | 95% LCL | 95% UCL |
|-------|-------|---------|---------|
| LC5   | 104.7 | 4.9     | 167.9   |
| LC10  | 116.4 | 7.487   | 179.4   |
| LC15  | 126.7 | 10.45   | 189.1   |
| LC20  | 136.2 | 13.95   | 198.2   |
| LC25  | 145.6 | 18.12   | 207.1   |
| LC40  | 174   | 36.36   | 234.4   |
| LC50  | 194.5 | 55.67   | 255.6   |

## Regression Parameters

| Parameter | Estimate | Std Error | 95% LCL | 95% UCL | t Stat | P-Value  | Decision( $\alpha$ :5%)   |
|-----------|----------|-----------|---------|---------|--------|----------|---------------------------|
| Threshold | 0.65     | 0.05333   | 0.5455  | 0.7545  | 12.19  | <1.0E-37 | Significant Parameter     |
| Slope     | 2.082    | 0.7988    | 0.5163  | 3.647   | 2.606  | 0.0165   | Significant Parameter     |
| Intercept | -3.98    | 1.947     | -7.796  | -0.1634 | -2.044 | 0.0537   | Non-Significant Parameter |

## ANOVA Table

| Source      | Sum Squares | Mean Square | DF | F Stat | P-Value | Decision( $\alpha$ :5%) |
|-------------|-------------|-------------|----|--------|---------|-------------------------|
| Model       | 24.42       | 12.21       | 2  | 32.45  | 3.8E-07 | Significant             |
| Lack of Fit | 0.2198      | 0.07326     | 3  | 0.1716 | 0.9142  | Non-Significant         |
| Pure Error  | 7.683       | 0.4268      | 18 |        |         |                         |
| Residual    | 7.903       | 0.3763      | 21 |        |         |                         |

## Residual Analysis

| Attribute       | Method                           | Test Stat | Critical | P-Value | Decision( $\alpha$ :5%)       |
|-----------------|----------------------------------|-----------|----------|---------|-------------------------------|
| Goodness-of-Fit | Pearson Chi-Sq GOF Test          | 7.903     | 32.67    | 0.9955  | Non-Significant Heterogeneity |
|                 | Likelihood Ratio GOF Test        | 8.213     | 32.67    | 0.9942  | Non-Significant Heterogeneity |
| Extreme Value   | Grubbs Extreme Value Test        | 2.828     | 2.802    | 0.0443  | Outlier Detected              |
| Variances       | Mod Levene Equality of Variance  | 0.6575    | 2.773    | 0.6600  | Equal Variances               |
| Distribution    | Shapiro-Wilk W Normality Test    | 0.8972    | 0.9169   | 0.0187  | Non-Normal Distribution       |
|                 | Anderson-Darling A2 Normality Te | 1.173     | 2.492    | 0.0046  | Non-Normal Distribution       |

# CETIS Analytical Report

Report Date: 12 Dec-18 16:28 (p 2 of 3)  
 Test Code/ID: SP1718-015 VHW / 14-9088-9246

Ephemeroptera (Mayfly) 28-d Test Nautilus Environmental Calgary

Analysis ID: 19-1846-4944      Endpoint: 28d Emergence Rate      CETIS Version: CETISv1.9.4  
 Analyzed: 12 Dec-18 16:28      Analysis: Linear Regression (GLM)      Status Level: 1

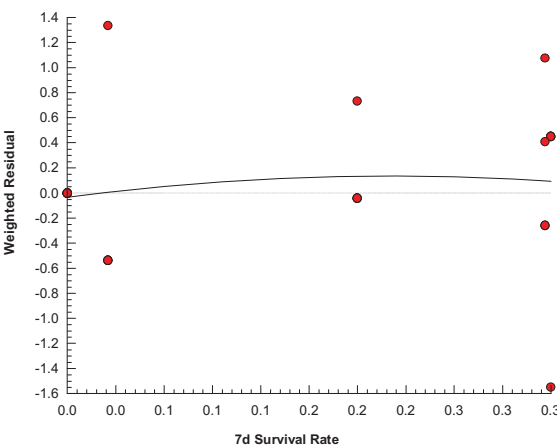
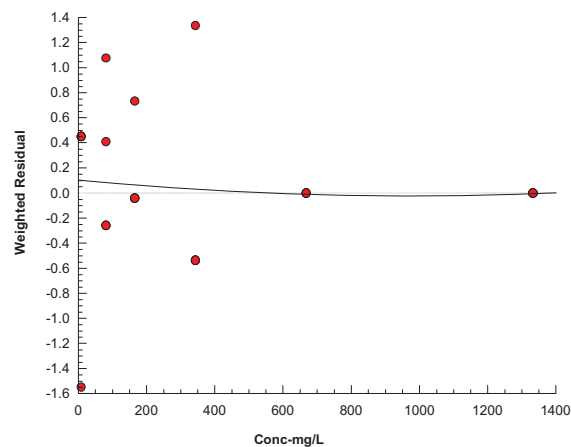
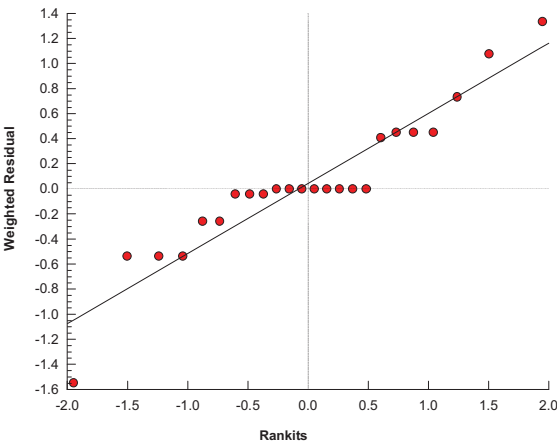
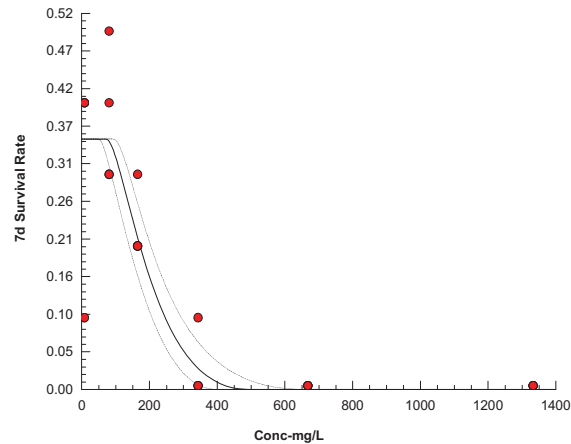
| 7d Survival Rate Summary |      |       | Calculated Variate(A/B) |        |        |         |         |         |         |    |    |
|--------------------------|------|-------|-------------------------|--------|--------|---------|---------|---------|---------|----|----|
| Conc-mg/L                | Code | Count | Mean                    | Min    | Max    | Std Err | Std Dev | CV%     | %Effect | A  | B  |
| 8.66                     | N    | 4     | 0.3250                  | 0.1000 | 0.4000 | 0.0750  | 0.1500  | 46.15%  | 0.0%    | 13 | 40 |
| 81.57                    |      | 4     | 0.3750                  | 0.3000 | 0.5000 | 0.0479  | 0.0957  | 25.53%  | -15.38% | 15 | 40 |
| 165.67                   |      | 4     | 0.2250                  | 0.2000 | 0.3000 | 0.0250  | 0.0500  | 22.22%  | 30.77%  | 9  | 40 |
| 343.67                   |      | 4     | 0.0250                  | 0.0000 | 0.1000 | 0.0250  | 0.0500  | 200.00% | 92.31%  | 1  | 40 |
| 668.33                   |      | 4     | 0.0000                  | 0.0000 | 0.0000 | 0.0000  | 0.0000  |         | 100.0%  | 0  | 40 |
| 1333.33                  |      | 4     | 0.0000                  | 0.0000 | 0.0000 | 0.0000  | 0.0000  |         | 100.0%  | 0  | 40 |

| 7d Survival Rate Detail |      |        |        |        |        |
|-------------------------|------|--------|--------|--------|--------|
| Conc-mg/L               | Code | Rep 1  | Rep 2  | Rep 3  | Rep 4  |
| 8.66                    | N    | 0.4000 | 0.4000 | 0.4000 | 0.1000 |
| 81.57                   |      | 0.3000 | 0.3000 | 0.4000 | 0.5000 |
| 165.67                  |      | 0.3000 | 0.2000 | 0.2000 | 0.2000 |
| 343.67                  |      | 0.1000 | 0.0000 | 0.0000 | 0.0000 |
| 668.33                  |      | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 1333.33                 |      | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

| 7d Survival Rate Binomials |      |       |       |       |       |
|----------------------------|------|-------|-------|-------|-------|
| Conc-mg/L                  | Code | Rep 1 | Rep 2 | Rep 3 | Rep 4 |
| 8.66                       | N    | 4/10  | 4/10  | 4/10  | 1/10  |
| 81.57                      |      | 3/10  | 3/10  | 4/10  | 5/10  |
| 165.67                     |      | 3/10  | 2/10  | 2/10  | 2/10  |
| 343.67                     |      | 1/10  | 0/10  | 0/10  | 0/10  |
| 668.33                     |      | 0/10  | 0/10  | 0/10  | 0/10  |
| 1333.33                    |      | 0/10  | 0/10  | 0/10  | 0/10  |

|                                  |                                   |                                |  |
|----------------------------------|-----------------------------------|--------------------------------|--|
| Ephemeroptera (Mayfly) 28-d Test |                                   | Nautilus Environmental Calgary |  |
| Analysis ID: 19-1846-4944        | Endpoint: 28d Emergence Rate      | CETIS Version: CETISv1.9.4     |  |
| Analyzed: 12 Dec-18 16:28        | Analysis: Linear Regression (GLM) | Status Level: 1                |  |

Graphics Log-angle:  $\arcsin[\sqrt{\pi}] = \alpha + \beta \cdot \log[x]$





## CETIS Analytical Report

Report Date: 04 Dec-18 09:27 (p 1 of 2)  
 Test Code/ID: SP1718-015 VHW / 14-9088-9246

| Ephemeroptera (Mayfly) 28-d Test |                |            |                              | Nautilus Environmental Calgary |               |
|----------------------------------|----------------|------------|------------------------------|--------------------------------|---------------|
| Analysis ID:                     | 18-7382-1372   | Endpoint:  | Mean Dry Weight-mg           | CETIS Version:                 | CETISv1.9.4   |
| Analyzed:                        | 04 Dec-18 9:27 | Analysis:  | Linear Interpolation (ICPIN) | Status Level:                  | 1             |
| Batch ID:                        | 19-8241-5883   | Test Type: | Growth-Survival (7d)         | Analyst:                       | Madison Lehti |
| Start Date:                      | 31 Aug-18      | Protocol:  | Not Applicable               | Diluent:                       |               |
| Ending Date:                     | 28 Sep-18      | Species:   | Ephemeroptera                | Brine:                         |               |
| Test Length:                     | 28d 0h         | Taxon:     |                              | Source:                        | Age:          |
| Sample ID:                       | 05-0251-6583   | Code:      | SP1718-015 VHW               | Project:                       |               |
| Sample Date:                     | 17 Aug-18      | Material:  | chloride                     | Source:                        | Equilibrium   |
| Receipt Date:                    | 17 Aug-18      | CAS (PC):  |                              | Station:                       | na            |
| Sample Age:                      | 14d 0h         | Client:    | Equilibrium                  |                                |               |

| Linear Interpolation Options |             |         |           |            |                         |
|------------------------------|-------------|---------|-----------|------------|-------------------------|
| X Transform                  | Y Transform | Seed    | Resamples | Exp 95% CL | Method                  |
| Log(X+1)                     | Linear      | 1141544 | 200       | Yes        | Two-Point Interpolation |

| Residual Analysis |                           |           |          |         |                                   |
|-------------------|---------------------------|-----------|----------|---------|-----------------------------------|
| Attribute         | Method                    | Test Stat | Critical | P-Value | Decision(α:5%)                    |
| Extreme Value     | Grubbs Extreme Value Test | 1.808     | 2.462    | 0.7156  | No Outliers Detected              |
| Control Trend     | Mann-Kendall Trend Test   | 1.808     |          | 0.7391  | Non-Significant Trend in Controls |

| Point Estimates |        |         |         |  |
|-----------------|--------|---------|---------|--|
| Level           | mg/L   | 95% LCL | 95% UCL |  |
| IC5             | >343.7 | n/a     | n/a     |  |
| IC10            | >343.7 | n/a     | n/a     |  |
| IC15            | >343.7 | n/a     | n/a     |  |
| IC20            | >343.7 | n/a     | n/a     |  |
| IC25            | >343.7 | n/a     | n/a     |  |
| IC40            | >343.7 | n/a     | n/a     |  |
| IC50            | >343.7 | n/a     | n/a     |  |

| Mean Dry Weight-mg Summary |      |       | Calculated Variate |        |        |         |        |         | Isotonic Variate |         |
|----------------------------|------|-------|--------------------|--------|--------|---------|--------|---------|------------------|---------|
| Conc-mg/L                  | Code | Count | Mean               | Min    | Max    | Std Dev | CV%    | %Effect | Mean             | %Effect |
| 8.66                       | N    | 4     | 0.5212             | 0.385  | 0.59   | 0.09313 | 17.87% | 0.0%    | 0.6773           | 0.0%    |
| 81.57                      |      | 4     | 0.6361             | 0.4825 | 0.7933 | 0.1315  | 20.68% | -22.04% | 0.6773           | 0.0%    |
| 165.67                     |      | 4     | 0.6017             | 0.49   | 0.79   | 0.132   | 21.94% | -15.43% | 0.6773           | 0.0%    |
| 343.67                     |      | 1     | 0.95               | 0.95   | 0.95   | 0       | 0.00%  | -82.25% | 0.6773           | 0.0%    |

| Mean Dry Weight-mg Detail |      |        |        |        |       |
|---------------------------|------|--------|--------|--------|-------|
| Conc-mg/L                 | Code | Rep 1  | Rep 2  | Rep 3  | Rep 4 |
| 8.66                      | N    | 0.57   | 0.385  | 0.54   | 0.59  |
| 81.57                     |      | 0.6767 | 0.7933 | 0.4825 | 0.592 |
| 165.67                    |      | 0.5367 | 0.79   | 0.59   | 0.49  |
| 343.67                    |      | 0.95   |        |        |       |

# CETIS Analytical Report

Report Date: 04 Dec-18 09:27 (p 2 of 2)  
Test Code/ID: SP1718-015 VHW / 14-9088-9246

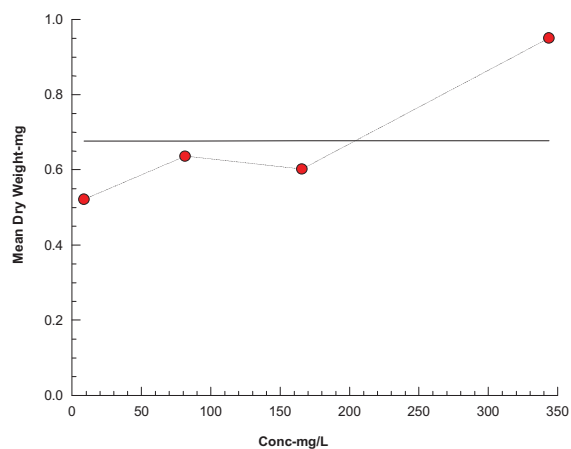
## Ephemeroptera (Mayfly) 28-d Test

Nautilus Environmental Calgary

Analysis ID: 18-7382-1372      Endpoint: Mean Dry Weight-mg  
Analyzed: 04 Dec-18 9:27      Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.9.4  
Status Level: 1

### Graphics



## **APPENDIX E – Analytical Data**

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Nautilus Environmental  
ATTN: Madison Lehti  
4-6125 12th Street SE  
Calgary AB T2H 2K1

Date Received: 17-AUG-18  
Report Date: 02-SEP-18 16:34 (MT)  
Version: FINAL

Client Phone: 403-253-7121

# Certificate of Analysis

Lab Work Order #: L2149383

Project P.O. #: 1718-0420

Job Reference:

C of C Numbers:

Legal Site Desc:



Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 2559 29 Street NE, Calgary, AB T1Y 7B5, Canada | Phone: +1 403 291 9897 | Fax: +1 403 291 0298





## ALS ENVIRONMENTAL ANALYTICAL REPORT

| Sample Details/Parameters                                                                                                                                                                                                                                                                                                                                                                                                                             | Result | Qualifier* | D.L. | Units | Extracted | Analyzed  | Batch    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------------|------|-------|-----------|-----------|----------|
| L2149383-1    SOFT WATER CTL<br>Sampled By:    CLIENT on 17-AUG-18 @ 08:45<br>Matrix:        WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)                      0.99<br>Sulfate (SO4)                      38.9<br><b>Total Metals in Water by ICPOES</b><br>Calcium (Ca)-Total                6.88<br>Magnesium (Mg)-Total            6.06<br>Potassium (K)-Total               1.07<br>Sodium (Na)-Total                13.8            |        |            |      |       |           |           |          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |            | 0.50 | mg/L  |           | 20-AUG-18 | R4180498 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |            | 0.30 | mg/L  |           | 21-AUG-18 | R4180498 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |            | 0.10 | mg/L  |           | 27-AUG-18 | R4185079 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |            | 0.10 | mg/L  |           | 27-AUG-18 | R4185079 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |            | 0.50 | mg/L  |           | 27-AUG-18 | R4185079 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |            | 1.0  | mg/L  |           | 27-AUG-18 | R4185079 |
| L2149383-2    HARD WATER CTL<br>Sampled By:    CLIENT on 17-AUG-18 @ 08:50<br>Matrix:        WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)                      3.85<br>Sulfate (SO4)                      155<br><b>Total Metals in Water by ICPOES</b><br>Calcium (Ca)-Total                25.9<br>Magnesium (Mg)-Total            24.0<br>Potassium (K)-Total               4.22<br>Sodium (Na)-Total                53.5             |        |            |      |       |           |           |          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |            | 0.50 | mg/L  |           | 20-AUG-18 | R4180498 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |            | 0.30 | mg/L  |           | 21-AUG-18 | R4180498 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |            | 0.10 | mg/L  |           | 27-AUG-18 | R4185079 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |            | 0.10 | mg/L  |           | 27-AUG-18 | R4185079 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |            | 0.50 | mg/L  |           | 27-AUG-18 | R4185079 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |            | 1.0  | mg/L  |           | 27-AUG-18 | R4185079 |
| L2149383-3    MODERATELY HARD WATER CTL<br>Sampled By:    CLIENT on 17-AUG-18 @ 08:45<br>Matrix:        WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)                      1.89<br>Sulfate (SO4)                      77.7<br><b>Total Metals in Water by ICPOES</b><br>Calcium (Ca)-Total                12.9<br>Magnesium (Mg)-Total            11.9<br>Potassium (K)-Total               2.06<br>Sodium (Na)-Total                26.8 |        |            |      |       |           |           |          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |            | 0.50 | mg/L  |           | 20-AUG-18 | R4180498 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |            | 0.30 | mg/L  |           | 21-AUG-18 | R4180498 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |            | 0.10 | mg/L  |           | 27-AUG-18 | R4185079 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |            | 0.10 | mg/L  |           | 27-AUG-18 | R4185079 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |            | 0.50 | mg/L  |           | 27-AUG-18 | R4185079 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |            | 1.0  | mg/L  |           | 27-AUG-18 | R4185079 |
| L2149383-4    VERY HARD WATER CTL<br>Sampled By:    CLIENT on 17-AUG-18 @ 08:50<br>Matrix:        WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)                      7.61<br>Sulfate (SO4)                      308<br><b>Total Metals in Water by ICPOES</b><br>Calcium (Ca)-Total                42.1<br>Magnesium (Mg)-Total            50.3<br>Potassium (K)-Total               8.29<br>Sodium (Na)-Total                105         |        |            |      |       |           |           |          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |            | 0.50 | mg/L  |           | 20-AUG-18 | R4180498 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |            | 0.30 | mg/L  |           | 21-AUG-18 | R4180498 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |            | 0.10 | mg/L  |           | 27-AUG-18 | R4185079 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |            | 0.10 | mg/L  |           | 27-AUG-18 | R4185079 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |            | 0.50 | mg/L  |           | 27-AUG-18 | R4185079 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |            | 1.0  | mg/L  |           | 27-AUG-18 | R4185079 |
| L2149383-5    SW-75-01<br>Sampled By:    CLIENT on 17-AUG-18 @ 13:00<br>Matrix:        WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)                      75.3                                                                                                                                                                                                                                                                            |        |            |      |       |           |           |          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |            | 0.50 | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-6    SW-75-02<br>Sampled By:    CLIENT on 17-AUG-18 @ 13:00<br>Matrix:        WATER<br><b>Miscellaneous Parameters</b>                                                                                                                                                                                                                                                                                                                       |        |            |      |       |           |           |          |

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

# ALS ENVIRONMENTAL ANALYTICAL REPORT

| Sample Details/Parameters                                                                                                              | Result | Qualifier* | D.L. | Units | Extracted | Analyzed  | Batch    |
|----------------------------------------------------------------------------------------------------------------------------------------|--------|------------|------|-------|-----------|-----------|----------|
| L2149383-6 SW-75-02<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br>Chloride (Cl)                                       | 75.5   |            | 0.50 | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-7 SW-150-01<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)   | 152    |            | 0.50 | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-8 SW-150-02<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)   | 152    |            | 0.50 | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-9 SW-300-01<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)   | 321    | DLHC       | 2.5  | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-10 SW-300-02<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)  | 321    | DLHC       | 2.5  | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-11 SW-600-01<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)  | 631    | DLHC       | 2.5  | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-12 SW-600-02<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)  | 631    | DLHC       | 2.5  | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-13 SW-1200-01<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl) | 1220   | DLHC       | 2.5  | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-14 SW-1200-02<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl) | 1250   | DLHC       | 2.5  | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-15 MHW-75-01<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)  | 75.9   |            | 0.50 | mg/L  |           | 20-AUG-18 | R4180498 |
|                                                                                                                                        |        |            |      |       |           |           |          |

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

# ALS ENVIRONMENTAL ANALYTICAL REPORT

| Sample Details/Parameters                                                                                                               | Result | Qualifier* | D.L. | Units | Extracted | Analyzed  | Batch    |
|-----------------------------------------------------------------------------------------------------------------------------------------|--------|------------|------|-------|-----------|-----------|----------|
| L2149383-16 MHW-75-02<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)   | 76.3   |            | 0.50 | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-17 MHW-150-01<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)  | 151    |            | 0.50 | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-18 MHW-150-02<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)  | 149    |            | 0.50 | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-19 MHW-300-01<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)  | 310    | DLHC       | 2.5  | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-20 MHW-300-02<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)  | 305    | DLHC       | 2.5  | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-21 MHW-600-01<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)  | 636    | DLHC       | 2.5  | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-22 MHW-600-02<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)  | 612    | DLHC       | 2.5  | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-23 MHW-1200-01<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl) | 1230   | DLHC       | 2.5  | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-24 MHW-1200-02<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl) | 1250   | DLHC       | 2.5  | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-25 HW-75-01<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)    | 74.8   |            | 0.50 | mg/L  |           | 20-AUG-18 | R4180498 |

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

# ALS ENVIRONMENTAL ANALYTICAL REPORT

| Sample Details/Parameters                                                                                                              | Result | Qualifier* | D.L. | Units | Extracted | Analyzed  | Batch    |
|----------------------------------------------------------------------------------------------------------------------------------------|--------|------------|------|-------|-----------|-----------|----------|
| L2149383-26 HW-75-02<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)   | 75.6   |            | 0.50 | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-27 HW-150-1<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)   | 156    | DLHC       | 2.5  | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-28 HW-150-02<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)  | 158    | DLHC       | 2.5  | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-29 HW-300-01<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)  | 313    | DLHC       | 2.5  | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-30 HW-300-02<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)  | 305    | DLHC       | 2.5  | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-31 HW-600-01<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)  | 619    | DLHC       | 2.5  | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-32 HW-600-02<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)  | 622    | DLHC       | 2.5  | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-33 HW-1200-01<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl) | 1270   | DLHC       | 2.5  | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-34 HW-1200-02<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl) | 1250   | DLHC       | 2.5  | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-35 VHW-75-01<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)  | 78.9   | DLHC       | 2.5  | mg/L  |           | 20-AUG-18 | R4180498 |

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.



# ALS ENVIRONMENTAL ANALYTICAL REPORT

| Sample Details/Parameters                                                                                                               | Result | Qualifier* | D.L. | Units | Extracted | Analyzed  | Batch    |
|-----------------------------------------------------------------------------------------------------------------------------------------|--------|------------|------|-------|-----------|-----------|----------|
| L2149383-36 VHW-75-02<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)   | 78.5   | DLHC       | 2.5  | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-37 VHW-150-01<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)  | 154    | DLHC       | 2.5  | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-38 VHW-150-02<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)  | 156    | DLHC       | 2.5  | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-39 VHW-300-01<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)  | 318    | DLHC       | 2.5  | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-40 VHW-300-02<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)  | 316    | DLHC       | 2.5  | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-41 VHW-600-01<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)  | 642    | DLHC       | 2.5  | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-42 VHW-600-02<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)  | 644    | DLHC       | 2.5  | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-43 VHW-1200-01<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl) | 1310   | DLHC       | 5.0  | mg/L  |           | 20-AUG-18 | R4180498 |
| L2149383-44 VHW-1200-02<br>Sampled By: CLIENT on 17-AUG-18 @ 13:00<br>Matrix: WATER<br><b>Miscellaneous Parameters</b><br>Chloride (Cl) | 1300   | DLHC       | 5.0  | mg/L  |           | 20-AUG-18 | R4180498 |
|                                                                                                                                         |        |            |      |       |           |           |          |

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

## Reference Information

## Qualifiers for Sample Submission Listed:

| Qualifier | Description                                            |
|-----------|--------------------------------------------------------|
| EXTEMP10  | 13 C - Samples Received with temperature >10 Degrees C |

## Sample Parameter Qualifier Key:

| Qualifier | Description                                                                             |
|-----------|-----------------------------------------------------------------------------------------|
| DLHC      | Detection Limit Raised: Dilution required due to high concentration of test analyte(s). |

## Test Method References:

| ALS Test Code                                                                                                                                                                                                                                                               | Matrix | Test Description                | Method Reference** |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|---------------------------------|--------------------|
| CL-IC-N-CL                                                                                                                                                                                                                                                                  | Water  | Chloride in Water by IC         | EPA 300.1 (mod)    |
| Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.                                                                                                                                                                                  |        |                                 |                    |
| MET-TOT-ICP-CL                                                                                                                                                                                                                                                              | Water  | Total Metals in Water by ICPOES | EPA 200.2/6010B    |
| Water samples are digested with nitric and hydrochloric acids, and analyzed by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B). Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method. |        |                                 |                    |
| SO4-IC-N-CL                                                                                                                                                                                                                                                                 | Water  | Sulfate in Water by IC          | EPA 300.1 (mod)    |
| Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.                                                                                                                                                                                  |        |                                 |                    |

\*\* ALS test methods may incorporate modifications from specified reference methods to improve performance.

*The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:*

| Laboratory Definition Code | Laboratory Location                          |
|----------------------------|----------------------------------------------|
| CL                         | ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA |

## Chain of Custody Numbers:

## GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg ww - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

# Quality Control Report

Workorder: L2149383

Report Date: 02-SEP-18

Page 1 of 3

Client: Nautilus Environmental  
4-6125 12th Street SE  
Calgary AB T2H 2K1  
Contact: Madison Lehti

| Test                    | Matrix          | Reference          | Result | Qualifier | Units | RPD | Limit  | Analyzed  |
|-------------------------|-----------------|--------------------|--------|-----------|-------|-----|--------|-----------|
| CL-IC-N-CL              | Water           |                    |        |           |       |     |        |           |
| <b>Batch</b>            | <b>R4180498</b> |                    |        |           |       |     |        |           |
| <b>WG2856901-11 DUP</b> |                 | <b>L2149383-15</b> |        |           |       |     |        |           |
| Chloride (Cl)           |                 | 75.9               | 76.0   |           | mg/L  | 0.1 | 20     | 20-AUG-18 |
| <b>WG2856901-15 DUP</b> |                 | <b>L2149383-26</b> |        |           |       |     |        |           |
| Chloride (Cl)           |                 | 75.6               | 75.9   |           | mg/L  | 0.4 | 20     | 20-AUG-18 |
| <b>WG2856901-19 DUP</b> |                 | <b>L2149383-42</b> |        |           |       |     |        |           |
| Chloride (Cl)           |                 | 644                | 641    |           | mg/L  | 0.4 | 20     | 20-AUG-18 |
| <b>WG2856901-10 LCS</b> |                 |                    |        |           |       |     |        |           |
| Chloride (Cl)           |                 |                    | 101.7  |           | %     |     | 90-110 | 20-AUG-18 |
| <b>WG2856901-14 LCS</b> |                 |                    |        |           |       |     |        |           |
| Chloride (Cl)           |                 |                    | 100.2  |           | %     |     | 90-110 | 20-AUG-18 |
| <b>WG2856901-18 LCS</b> |                 |                    |        |           |       |     |        |           |
| Chloride (Cl)           |                 |                    | 101.2  |           | %     |     | 90-110 | 20-AUG-18 |
| <b>WG2856901-13 MB</b>  |                 |                    |        |           |       |     |        |           |
| Chloride (Cl)           |                 |                    | <0.50  |           | mg/L  |     | 0.5    | 20-AUG-18 |
| <b>WG2856901-17 MB</b>  |                 |                    |        |           |       |     |        |           |
| Chloride (Cl)           |                 |                    | <0.50  |           | mg/L  |     | 0.5    | 20-AUG-18 |
| <b>WG2856901-9 MB</b>   |                 |                    |        |           |       |     |        |           |
| Chloride (Cl)           |                 |                    | <0.50  |           | mg/L  |     | 0.5    | 20-AUG-18 |
| <b>WG2856901-12 MS</b>  |                 | <b>L2149383-15</b> |        |           |       |     |        |           |
| Chloride (Cl)           |                 |                    | 110.5  |           | %     |     | 75-125 | 20-AUG-18 |
| <b>WG2856901-16 MS</b>  |                 | <b>L2149383-26</b> |        |           |       |     |        |           |
| Chloride (Cl)           |                 |                    | 108.8  |           | %     |     | 75-125 | 20-AUG-18 |
| MET-TOT-ICP-CL          | Water           |                    |        |           |       |     |        |           |
| <b>Batch</b>            | <b>R4185079</b> |                    |        |           |       |     |        |           |
| <b>WG2859541-2 LCS</b>  |                 | <b>TMRM</b>        |        |           |       |     |        |           |
| Calcium (Ca)-Total      |                 |                    | 97.0   |           | %     |     | 80-120 | 27-AUG-18 |
| Magnesium (Mg)-Total    |                 |                    | 101.2  |           | %     |     | 80-120 | 27-AUG-18 |
| Potassium (K)-Total     |                 |                    | 95.8   |           | %     |     | 80-120 | 27-AUG-18 |
| Sodium (Na)-Total       |                 |                    | 95.6   |           | %     |     | 80-120 | 27-AUG-18 |
| <b>WG2859541-5 LCS</b>  |                 | <b>TMRM</b>        |        |           |       |     |        |           |
| Calcium (Ca)-Total      |                 |                    | 99.2   |           | %     |     | 80-120 | 27-AUG-18 |
| Magnesium (Mg)-Total    |                 |                    | 101.7  |           | %     |     | 80-120 | 27-AUG-18 |
| Potassium (K)-Total     |                 |                    | 95.7   |           | %     |     | 80-120 | 27-AUG-18 |
| Sodium (Na)-Total       |                 |                    | 96.3   |           | %     |     | 80-120 | 27-AUG-18 |
| <b>WG2859541-1 MB</b>   |                 |                    |        |           |       |     |        |           |
| Calcium (Ca)-Total      |                 |                    | <0.10  |           | mg/L  |     | 0.1    | 27-AUG-18 |
| Magnesium (Mg)-Total    |                 |                    | <0.10  |           | mg/L  |     | 0.1    | 27-AUG-18 |
| Potassium (K)-Total     |                 |                    | <0.50  |           | mg/L  |     | 0.5    | 27-AUG-18 |

## Quality Control Report

Workorder: L2149383

Report Date: 02-SEP-18

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| Test                 | Matrix   | Reference | Result | Qualifier | Units | RPD | Limit  | Analyzed  |
|----------------------|----------|-----------|--------|-----------|-------|-----|--------|-----------|
| MET-TOT-ICP-CL       | Water    |           |        |           |       |     |        |           |
| Batch                | R4185079 |           |        |           |       |     |        |           |
| WG2859541-1 MB       |          |           |        |           |       |     |        |           |
| Sodium (Na)-Total    |          |           | <1.0   |           | mg/L  |     | 1      | 27-AUG-18 |
| WG2859541-4 MB       |          |           |        |           |       |     |        |           |
| Calcium (Ca)-Total   |          |           | <0.10  |           | mg/L  |     | 0.1    | 27-AUG-18 |
| Magnesium (Mg)-Total |          |           | <0.10  |           | mg/L  |     | 0.1    | 27-AUG-18 |
| Potassium (K)-Total  |          |           | <0.50  |           | mg/L  |     | 0.5    | 27-AUG-18 |
| Sodium (Na)-Total    |          |           | <1.0   |           | mg/L  |     | 1      | 27-AUG-18 |
| SO4-IC-N-CL          | Water    |           |        |           |       |     |        |           |
| Batch                | R4180498 |           |        |           |       |     |        |           |
| WG2856901-10 LCS     |          |           |        |           |       |     |        |           |
| Sulfate (SO4)        |          |           | 98.7   |           | %     |     | 90-110 | 20-AUG-18 |
| WG2856901-9 MB       |          |           |        |           |       |     |        |           |
| Sulfate (SO4)        |          |           | <0.30  |           | mg/L  |     | 0.3    | 20-AUG-18 |



# Quality Control Report

Workorder: L2149383

Report Date: 02-SEP-18

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## Legend:

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|       |                                             |
|-------|---------------------------------------------|
| Limit | ALS Control Limit (Data Quality Objectives) |
| DUP   | Duplicate                                   |
| RPD   | Relative Percent Difference                 |
| N/A   | Not Available                               |
| LCS   | Laboratory Control Sample                   |
| SRM   | Standard Reference Material                 |
| MS    | Matrix Spike                                |
| MSD   | Matrix Spike Duplicate                      |
| ADE   | Average Desorption Efficiency               |
| MB    | Method Blank                                |
| IRM   | Internal Reference Material                 |
| CRM   | Certified Reference Material                |
| CCV   | Continuing Calibration Verification         |
| CVS   | Calibration Verification Standard           |
| LCSD  | Laboratory Control Sample Duplicate         |

## Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

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The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



Nautilus Environmental  
ATTN: Madison Lehti/ Jacklyn Poole  
#4, 6125 - 12 Street SE  
Calgary AB T2H 2K1

Date Received: 02-OCT-18  
Report Date: 10-OCT-18 14:45 (MT)  
Version: FINAL

Client Phone: 403-253-7121

## Certificate of Analysis

Lab Work Order #: L2174648

Project P.O. #: 2018-0042

Job Reference:

C of C Numbers:

Legal Site Desc:



Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 2559 29 Street NE, Calgary, AB T1Y 7B5, Canada | Phone: +1 403 291 9897 | Fax: +1 403 291 0298



## ALS ENVIRONMENTAL ANALYTICAL REPORT

| Sample Details/Parameters                                                                                                                                                                                                                                                                                                   | Result | Qualifier*   | D.L.       | Units        | Extracted | Analyzed               | Batch                |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------|------------|--------------|-----------|------------------------|----------------------|
| L2174648-1 SW-CTL-FINAL<br>Sampled By: CLIENT on 02-OCT-18 @ 11:55<br>Matrix: water<br><b>Miscellaneous Parameters</b><br>Chloride (Cl) 1.42<br>Sulfate (SO4) 43.1<br><b>Total Metals in Water by ICPOES</b><br>Calcium (Ca)-Total 7.26<br>Magnesium (Mg)-Total 6.77<br>Potassium (K)-Total 1.16<br>Sodium (Na)-Total 15.2  |        |              |            |              |           |                        |                      |
|                                                                                                                                                                                                                                                                                                                             |        |              | 0.50       | mg/L         |           | 03-OCT-18              | R4259530             |
|                                                                                                                                                                                                                                                                                                                             |        |              | 0.30       | mg/L         |           | 03-OCT-18              | R4259530             |
|                                                                                                                                                                                                                                                                                                                             |        |              | 0.10       | mg/L         |           | 10-OCT-18              | R4268110             |
|                                                                                                                                                                                                                                                                                                                             |        |              | 0.10       | mg/L         |           | 10-OCT-18              | R4268110             |
|                                                                                                                                                                                                                                                                                                                             |        |              | 0.50       | mg/L         |           | 10-OCT-18              | R4268110             |
|                                                                                                                                                                                                                                                                                                                             |        |              | 1.0        | mg/L         |           | 10-OCT-18              | R4268110             |
| L2174648-2 HW-CTL-FINAL<br>Sampled By: CLIENT on 02-OCT-18 @ 11:55<br>Matrix: water<br><b>Miscellaneous Parameters</b><br>Chloride (Cl) 5.02<br>Sulfate (SO4) 188<br><b>Total Metals in Water by ICPOES</b><br>Calcium (Ca)-Total 32.5<br>Magnesium (Mg)-Total 30.9<br>Potassium (K)-Total 5.02<br>Sodium (Na)-Total 63.8   |        |              |            |              |           |                        |                      |
|                                                                                                                                                                                                                                                                                                                             |        |              | 0.50       | mg/L         |           | 03-OCT-18              | R4259530             |
|                                                                                                                                                                                                                                                                                                                             |        |              | 0.30       | mg/L         |           | 03-OCT-18              | R4259530             |
|                                                                                                                                                                                                                                                                                                                             |        |              | 0.10       | mg/L         |           | 10-OCT-18              | R4268110             |
|                                                                                                                                                                                                                                                                                                                             |        |              | 0.10       | mg/L         |           | 10-OCT-18              | R4268110             |
|                                                                                                                                                                                                                                                                                                                             |        |              | 0.50       | mg/L         |           | 10-OCT-18              | R4268110             |
|                                                                                                                                                                                                                                                                                                                             |        |              | 1.0        | mg/L         |           | 10-OCT-18              | R4268110             |
| L2174648-3 MHW-CTL-FINAL<br>Sampled By: CLIENT on 02-OCT-18 @ 11:55<br>Matrix: water<br><b>Miscellaneous Parameters</b><br>Chloride (Cl) 2.60<br>Sulfate (SO4) 90.0<br><b>Total Metals in Water by ICPOES</b><br>Calcium (Ca)-Total 14.8<br>Magnesium (Mg)-Total 14.4<br>Potassium (K)-Total 2.42<br>Sodium (Na)-Total 32.1 |        |              |            |              |           |                        |                      |
|                                                                                                                                                                                                                                                                                                                             |        |              | 0.50       | mg/L         |           | 03-OCT-18              | R4259530             |
|                                                                                                                                                                                                                                                                                                                             |        |              | 0.30       | mg/L         |           | 03-OCT-18              | R4259530             |
|                                                                                                                                                                                                                                                                                                                             |        |              | 0.10       | mg/L         |           | 10-OCT-18              | R4268110             |
|                                                                                                                                                                                                                                                                                                                             |        |              | 0.10       | mg/L         |           | 10-OCT-18              | R4268110             |
|                                                                                                                                                                                                                                                                                                                             |        |              | 0.50       | mg/L         |           | 10-OCT-18              | R4268110             |
|                                                                                                                                                                                                                                                                                                                             |        |              | 1.0        | mg/L         |           | 10-OCT-18              | R4268110             |
| L2174648-4 VHW-CTL-FINAL<br>Sampled By: CLIENT on 02-OCT-18 @ 11:55<br>Matrix: water<br><b>Miscellaneous Parameters</b><br>Chloride (Cl) 9.7<br>Sulfate (SO4) 371<br><b>Total Metals in Water by ICPOES</b><br>Calcium (Ca)-Total 37.6<br>Magnesium (Mg)-Total 56.9<br>Potassium (K)-Total 9.28<br>Sodium (Na)-Total 117    |        | DLHC<br>DLHC | 2.5<br>1.5 | mg/L<br>mg/L |           | 03-OCT-18<br>03-OCT-18 | R4259530<br>R4259530 |
|                                                                                                                                                                                                                                                                                                                             |        |              | 0.10       | mg/L         |           | 10-OCT-18              | R4268110             |
|                                                                                                                                                                                                                                                                                                                             |        |              | 0.10       | mg/L         |           | 10-OCT-18              | R4268110             |
|                                                                                                                                                                                                                                                                                                                             |        |              | 0.50       | mg/L         |           | 10-OCT-18              | R4268110             |
|                                                                                                                                                                                                                                                                                                                             |        |              | 1.0        | mg/L         |           | 10-OCT-18              | R4268110             |
| L2174648-5 SW-75-FINAL<br>Sampled By: CLIENT on 02-OCT-18 @ 11:55<br>Matrix: water<br><b>Miscellaneous Parameters</b><br>Chloride (Cl) 83.2                                                                                                                                                                                 |        |              | 0.50       | mg/L         |           | 03-OCT-18              | R4259530             |
| L2174648-6 SW-150-FINAL<br>Sampled By: CLIENT on 02-OCT-18 @ 11:55<br>Matrix: water<br><b>Miscellaneous Parameters</b>                                                                                                                                                                                                      |        |              |            |              |           |                        |                      |

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

# ALS ENVIRONMENTAL ANALYTICAL REPORT

| Sample Details/Parameters                                                                                                                  | Result | Qualifier* | D.L. | Units | Extracted | Analyzed  | Batch    |
|--------------------------------------------------------------------------------------------------------------------------------------------|--------|------------|------|-------|-----------|-----------|----------|
| L2174648-6 SW-150-FINAL<br>Sampled By: CLIENT on 02-OCT-18 @ 11:55<br>Matrix: water<br>Chloride (Cl)                                       | 158    |            | 0.50 | mg/L  |           | 03-OCT-18 | R4259530 |
| L2174648-7 SW-300-FINAL<br>Sampled By: CLIENT on 02-OCT-18 @ 11:55<br>Matrix: water<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)    | 337    | DLHC       | 2.5  | mg/L  |           | 03-OCT-18 | R4259530 |
| L2174648-8 SW-600-FINAL<br>Sampled By: CLIENT on 02-OCT-18 @ 11:55<br>Matrix: water<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)    | 676    | DLHC       | 2.5  | mg/L  |           | 03-OCT-18 | R4259530 |
| L2174648-9 SW-1200-FINAL<br>Sampled By: CLIENT on 02-OCT-18 @ 11:55<br>Matrix: water<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)   | 1370   | DLHC       | 5.0  | mg/L  |           | 03-OCT-18 | R4259530 |
| L2174648-10 MHW-75-FINAL<br>Sampled By: CLIENT on 02-OCT-18 @ 11:55<br>Matrix: water<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)   | 81.8   |            | 0.50 | mg/L  |           | 03-OCT-18 | R4259530 |
| L2174648-11 MHW-150-FINAL<br>Sampled By: CLIENT on 02-OCT-18 @ 11:55<br>Matrix: water<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)  | 163    |            | 0.50 | mg/L  |           | 03-OCT-18 | R4259530 |
| L2174648-12 MHW-300-FINAL<br>Sampled By: CLIENT on 02-OCT-18 @ 11:55<br>Matrix: water<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)  | 358    | DLHC       | 2.5  | mg/L  |           | 03-OCT-18 | R4259530 |
| L2174648-13 MHW-600-FINAL<br>Sampled By: CLIENT on 02-OCT-18 @ 12:00<br>Matrix: water<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)  | 673    | DLHC       | 2.5  | mg/L  |           | 03-OCT-18 | R4259530 |
| L2174648-14 MHW-1200-FINAL<br>Sampled By: CLIENT on 02-OCT-18 @ 12:00<br>Matrix: water<br><b>Miscellaneous Parameters</b><br>Chloride (Cl) | 1360   | DLHC       | 5.0  | mg/L  |           | 03-OCT-18 | R4259530 |
| L2174648-15 HW-75-FINAL<br>Sampled By: CLIENT on 02-OCT-18 @ 12:00<br>Matrix: water<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)    | 92.4   | DLHC       | 2.5  | mg/L  |           | 03-OCT-18 | R4259530 |
|                                                                                                                                            |        |            |      |       |           |           |          |

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.



# ALS ENVIRONMENTAL ANALYTICAL REPORT

| Sample Details/Parameters                                                                                                                  | Result | Qualifier* | D.L. | Units | Extracted | Analyzed  | Batch    |
|--------------------------------------------------------------------------------------------------------------------------------------------|--------|------------|------|-------|-----------|-----------|----------|
| L2174648-16 HW-150-FINAL<br>Sampled By: CLIENT on 02-OCT-18 @ 12:00<br>Matrix: water<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)   | 184    | DLHC       | 2.5  | mg/L  |           | 03-OCT-18 | R4259530 |
| L2174648-17 HW-300-FINAL<br>Sampled By: CLIENT on 02-OCT-18 @ 12:00<br>Matrix: water<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)   | 356    | DLHC       | 2.5  | mg/L  |           | 03-OCT-18 | R4259530 |
| L2174648-18 HW-600-FINAL<br>Sampled By: CLIENT on 02-OCT-18 @ 12:00<br>Matrix: water<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)   | 684    | DLHC       | 2.5  | mg/L  |           | 03-OCT-18 | R4259530 |
| L2174648-19 HW-1200-FINAL<br>Sampled By: CLIENT on 02-OCT-18 @ 12:00<br>Matrix: water<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)  | 1380   | DLHC       | 5.0  | mg/L  |           | 03-OCT-18 | R4259530 |
| L2174648-20 VHW-75-FINAL<br>Sampled By: CLIENT on 02-OCT-18 @ 12:00<br>Matrix: water<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)   | 87.3   | DLHC       | 2.5  | mg/L  |           | 03-OCT-18 | R4259530 |
| L2174648-21 VHW-150-FINAL<br>Sampled By: CLIENT on 02-OCT-18 @ 12:00<br>Matrix: water<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)  | 187    | DLHC       | 2.5  | mg/L  |           | 03-OCT-18 | R4259530 |
| L2174648-22 VHW-300-FINAL<br>Sampled By: CLIENT on 02-OCT-18 @ 12:00<br>Matrix: water<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)  | 397    | DLHC       | 2.5  | mg/L  |           | 03-OCT-18 | R4259530 |
| L2174648-23 VHW-600-FINAL<br>Sampled By: CLIENT on 02-OCT-18 @ 12:00<br>Matrix: water<br><b>Miscellaneous Parameters</b><br>Chloride (Cl)  | 719    | DLHC       | 2.5  | mg/L  |           | 03-OCT-18 | R4259530 |
| L2174648-24 VHW-1200-FINAL<br>Sampled By: CLIENT on 02-OCT-18 @ 12:00<br>Matrix: water<br><b>Miscellaneous Parameters</b><br>Chloride (Cl) | 1390   | DLHC       | 5.0  | mg/L  |           | 03-OCT-18 | R4259530 |
|                                                                                                                                            |        |            |      |       |           |           |          |

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

## Reference Information

## Sample Parameter Qualifier Key:

| Qualifier | Description                                                                                        |
|-----------|----------------------------------------------------------------------------------------------------|
| DLHC      | Detection Limit Raised: Dilution required due to high concentration of test analyte(s).            |
| MS-B      | Matrix Spike recovery could not be accurately calculated due to high analyte background in sample. |

## Test Method References:

| ALS Test Code                                                                                                                                                                                                                                                               | Matrix | Test Description                | Method Reference** |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|---------------------------------|--------------------|
| CL-IC-N-CL                                                                                                                                                                                                                                                                  | Water  | Chloride in Water by IC         | EPA 300.1 (mod)    |
| Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.                                                                                                                                                                                  |        |                                 |                    |
| MET-TOT-ICP-CL                                                                                                                                                                                                                                                              | Water  | Total Metals in Water by ICPOES | EPA 200.2/6010B    |
| Water samples are digested with nitric and hydrochloric acids, and analyzed by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B). Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method. |        |                                 |                    |
| SO4-IC-N-CL                                                                                                                                                                                                                                                                 | Water  | Sulfate in Water by IC          | EPA 300.1 (mod)    |
| Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.                                                                                                                                                                                  |        |                                 |                    |

\*\* ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

| Laboratory Definition Code | Laboratory Location                          |
|----------------------------|----------------------------------------------|
| CL                         | ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA |

## Chain of Custody Numbers:

## GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg ww - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

# Quality Control Report

Workorder: L2174648

Report Date: 10-OCT-18

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Client: Nautilus Environmental  
 #4, 6125 - 12 Street SE  
 Calgary AB T2H 2K1  
 Contact: Madison Lehti/ Jacklyn Poole

| Test                 | Matrix          | Reference          | Result | Qualifier | Units | RPD | Limit  | Analyzed  |
|----------------------|-----------------|--------------------|--------|-----------|-------|-----|--------|-----------|
| CL-IC-N-CL           | Water           |                    |        |           |       |     |        |           |
| <b>Batch</b>         | <b>R4259530</b> |                    |        |           |       |     |        |           |
| <b>WG2895381-7</b>   | <b>DUP</b>      | <b>L2174648-11</b> |        |           |       |     |        |           |
| Chloride (Cl)        |                 | 163                | 163    |           | mg/L  | 0.2 | 20     | 03-OCT-18 |
| <b>WG2895381-10</b>  | <b>LCS</b>      |                    |        |           |       |     |        |           |
| Chloride (Cl)        |                 |                    | 101.5  |           | %     |     | 90-110 | 03-OCT-18 |
| <b>WG2895381-6</b>   | <b>LCS</b>      |                    |        |           |       |     |        |           |
| Chloride (Cl)        |                 |                    | 101.5  |           | %     |     | 90-110 | 03-OCT-18 |
| <b>WG2895381-5</b>   | <b>MB</b>       |                    |        |           |       |     |        |           |
| Chloride (Cl)        |                 |                    | <0.50  |           | mg/L  |     | 0.5    | 03-OCT-18 |
| <b>WG2895381-9</b>   | <b>MB</b>       |                    |        |           |       |     |        |           |
| Chloride (Cl)        |                 |                    | <0.50  |           | mg/L  |     | 0.5    | 03-OCT-18 |
| <b>WG2895381-8</b>   | <b>MS</b>       | <b>L2174648-11</b> |        |           |       |     |        |           |
| Chloride (Cl)        |                 |                    | N/A    | MS-B      | %     |     | -      | 03-OCT-18 |
| MET-TOT-ICP-CL       | Water           |                    |        |           |       |     |        |           |
| <b>Batch</b>         | <b>R4268110</b> |                    |        |           |       |     |        |           |
| <b>WG2898808-2</b>   | <b>LCS</b>      | <b>TMRM</b>        |        |           |       |     |        |           |
| Calcium (Ca)-Total   |                 |                    | 102.7  |           | %     |     | 80-120 | 10-OCT-18 |
| Magnesium (Mg)-Total |                 |                    | 103.9  |           | %     |     | 80-120 | 10-OCT-18 |
| Potassium (K)-Total  |                 |                    | 95.9   |           | %     |     | 80-120 | 10-OCT-18 |
| Sodium (Na)-Total    |                 |                    | 98.1   |           | %     |     | 80-120 | 10-OCT-18 |
| <b>WG2898808-1</b>   | <b>MB</b>       |                    |        |           |       |     |        |           |
| Calcium (Ca)-Total   |                 |                    | <0.10  |           | mg/L  |     | 0.1    | 10-OCT-18 |
| Magnesium (Mg)-Total |                 |                    | <0.10  |           | mg/L  |     | 0.1    | 10-OCT-18 |
| Potassium (K)-Total  |                 |                    | <0.50  |           | mg/L  |     | 0.5    | 10-OCT-18 |
| Sodium (Na)-Total    |                 |                    | <1.0   |           | mg/L  |     | 1      | 10-OCT-18 |
| SO4-IC-N-CL          | Water           |                    |        |           |       |     |        |           |
| <b>Batch</b>         | <b>R4259530</b> |                    |        |           |       |     |        |           |
| <b>WG2895381-6</b>   | <b>LCS</b>      |                    |        |           |       |     |        |           |
| Sulfate (SO4)        |                 |                    | 101.8  |           | %     |     | 90-110 | 03-OCT-18 |
| <b>WG2895381-5</b>   | <b>MB</b>       |                    |        |           |       |     |        |           |
| Sulfate (SO4)        |                 |                    | <0.30  |           | mg/L  |     | 0.3    | 03-OCT-18 |

# Quality Control Report

Workorder: L2174648

Report Date: 10-OCT-18

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## Legend:

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|       |                                             |
|-------|---------------------------------------------|
| Limit | ALS Control Limit (Data Quality Objectives) |
| DUP   | Duplicate                                   |
| RPD   | Relative Percent Difference                 |
| N/A   | Not Available                               |
| LCS   | Laboratory Control Sample                   |
| SRM   | Standard Reference Material                 |
| MS    | Matrix Spike                                |
| MSD   | Matrix Spike Duplicate                      |
| ADE   | Average Desorption Efficiency               |
| MB    | Method Blank                                |
| IRM   | Internal Reference Material                 |
| CRM   | Certified Reference Material                |
| CCV   | Continuing Calibration Verification         |
| CVS   | Calibration Verification Standard           |
| LCSD  | Laboratory Control Sample Duplicate         |

## Sample Parameter Qualifier Definitions:

---

| Qualifier | Description                                                                                        |
|-----------|----------------------------------------------------------------------------------------------------|
| MS-B      | Matrix Spike recovery could not be accurately calculated due to high analyte background in sample. |

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## Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

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The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



**END OF REPORT**

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**APPENDIX C**

**SUMMARY OF BMDS RECALCULATED VALUES**

## ***Musculium secures* (Mackie, 1978) Benchmark Dose Calculation**

**Figure C-1. BMDS Input and Output**

**BMDS Input Table: Log-Probit Dichotomous Model**

| Dose | N   | Effect |
|------|-----|--------|
| 0    | 100 | 0      |
| 121  | 100 | 46     |
| 243  | 100 | 59     |
| 364  | 100 | 84     |
| 485  | 100 | 91     |
| 607  | 100 | 100    |

Notes:

Dose- Chloride, mg/L; N – percent of organisms per dose, effect – percent of organisms affected

Hardness: non-specified

**BMDS Output Plot: EC<sub>25</sub> = 88 mg/L**

