## Table F-1VOCs in WasteReference Remedy Groundwater TreatmentCapital Costs

|  |       | stimated | Estimated |                  |    | Total    |
|--|-------|----------|-----------|------------------|----|----------|
| Item                                     |       | Unit     | Quantity  | Units            | E  | stimated |
|  |       | Cost     | Quantity  |                  |    | Cost     |
| 411-P Wellhead Treatment System          | (75 ( | GPM)     |           |                  |    |          |
| Subgrade Preparation                     | \$    | 1,000    | 1         | Ea               | \$ | 1,000    |
| ABC Backfill                             | \$    | 7        | 6         | SY               | \$ | 40       |
| Slab-on-Grade                            | \$    | 200      | 3         | CY               | \$ | 600      |
| Rebar Reinforcement                      | \$    | 300      | 1         | Ea               | \$ | 300      |
| CMU Wall                                 | \$    | 5,000    | 1         | Ea               | \$ | 5,000    |
| Carbon System (2 vessels) <sup>(1)</sup> | \$    | 60,000   | 1         | Ea               | \$ | 60,000   |
| Bag Filters                              | \$    | 3,000    | 2         | Ea               | \$ | 6,000    |
| Valves                                   | \$    | 3,000    | 1         | Ea               | \$ | 3,000    |
| Instrumentation                          | \$    | 5,000    | 1         | Ea               | \$ | 5,000    |
| Piping                                   | \$    | 5,000    | 1         | Ea               | \$ | 5,000    |
| Booster Pump                             | \$    | 2,000    | 1         | Ea               | \$ | 2,000    |
| Flow Meter                               | \$    | 1,000    | 1         | Ea               | \$ | 1,000    |
| Contractor Labor Mechanical              | \$    | 10,000   | 1         | Ea               | \$ | 10,000   |
|  |       |          |           | System Subtotal  | \$ | 99,000   |
| C-051B Wellhead Treatment Syster         | n (3  | 50 GPM)  |           |                  |    |          |
| Subgrade Preparation                     | \$    | 1,000    | 1         | Ea               | \$ | 1,000    |
| ABC Backfill                             | \$    | 7        | 65        | SY               | \$ | 400      |
| Slab-on-Grade                            | \$    | 200      | 11        | CY               | \$ | 2,200    |
| Rebar Reinforcement                      | \$    | 5,000    | 1         | Ea               | \$ | 5,000    |
| CMU WALL                                 | \$    | 15,000   | 1         | Ea               | \$ | 15,000   |
| Carbon System (2 Vessels) <sup>(1)</sup> | \$    | 170,000  | 1         | Ea               | \$ | 170,000  |
| Bag Filters                              | \$    | 15,000   | 2         | Ea               | \$ | 30,000   |
| Valves                                   | \$    | 10,000   | 1         | Ea               | \$ | 10,000   |
| Instrumentation                          | \$    | 10,000   | 1         | Ea               | \$ | 10,000   |
| Piping                                   | \$    | 10,000   | 1         | Ea               | \$ | 10,000   |
| Booster Pump                             | \$    | 2,000    | 1         | Ea               | \$ | 2,000    |
| Flow Meter                               | \$    | 2,000    | 1         | Ea               | \$ | 2,000    |
| Contractor Labor Mechanical              | \$    | 30,000   | 1         | Ea               | \$ | 30,000   |
| Electrical                               | \$    | 15,000   | 1         | Ea               | \$ | 15,000   |
|  |       |          |           | System Subtotal  | \$ | 303,000  |
| Perimeter Fencing                        |       |          |           |                  |    |          |
| Broadway North Landfill                  | \$    | 44       | 5300      | L.F.             | \$ | 233,200  |
| Broadway South Landfill                  | \$    | 44       | 6000      | L.F.             | \$ | 264,000  |
|  |       |          |           | Fencing Subtotal | \$ | 497,200  |
|  |       |          |           | Const. Subtotal  | \$ | 899,000  |

### Table F-1VOCs in WasteReference Remedy Groundwater TreatmentCapital Costs

| Item                    | Estimated<br>Unit<br>Cost | Estimated<br>Quantity | Units              | E  | Total<br>Estimated<br>Cost |  |  |
|-------------------------|---------------------------|-----------------------|--------------------|----|----------------------------|--|--|
| Contractor Markups      |                           |                       |                    |    |                            |  |  |
| Survey                  |                           | 2%                    | of Const. Subtotal | \$ | 18,000                     |  |  |
| QA/QC                   |                           | 4%                    | of Const. Subtotal | \$ | 36,000                     |  |  |
| Mobilization            |                           | 8%                    | of Const. Subtotal | \$ | 72,000                     |  |  |
| General Conditions      |                           | 10%                   | of Const. Subtotal | \$ | 90,000                     |  |  |
|                         |                           |                       | Const. Total       | \$ | 1,115,000                  |  |  |
| Engineering             |                           | 6%                    | of Const. Total    | \$ | 67,000                     |  |  |
| Construction Management |                           | 6%                    | of Const. Total    | \$ | 67,000                     |  |  |
|                         |                           |                       | Total              | \$ | 1,249,000                  |  |  |

Notes:

- Costs are presented in 2016 US Dollars (\$US 2016) and total and subtotal costs are rounded to the nearest \$1,000

- The estimated unit costs presented are for planning purposed only, at the feasibility study level (-30% to +50%).

- The remedial approach and associated costs summarized here will be refined during the design and construction contracting phase.

- Costs were developed using 2016 RS Means and cost information from similar projects

<sup>(1)</sup> Includes initial granular activated carbon

% - percent

Const. - Construction

C.Y. - cubic yards

Ea - each

GPM - gallons per minute

QA/QC - quality assurance/quality control

S.Y. - square yards

# Table F-2VOCs in WasteLess Aggressive Remedy Groundwater TreatmentCapital Costs

|  | E    | stimated | Estimated |                 | Total     |         |  |
|--|------|----------|-----------|-----------------|-----------|---------|--|
| Item                                     |      | Unit     | Quantity  | Units           | Estimated |         |  |
|  |      | Cost     |           | Cost            |           |         |  |
| 411-P Wellhead Treatment System          | (75  | GPM)     |           |                 |           |         |  |
| Subgrade Preparation                     | \$   | 1,000    | 1         | Ea              | \$        | 1,000   |  |
| ABC Backfill                             | \$   | 7        | 6         | S.Y.            | \$        | 39      |  |
| Slab-on-Grade                            | \$   | 200      | 3         | C.Y.            | \$        | 600     |  |
| Rebar Reinforcement                      | \$   | 300      | 1         | Ea              | \$        | 300     |  |
| CMU Wall                                 | \$   | 5,000    | 1         | Ea              | \$        | 5,000   |  |
| Carbon System (2 Vessels) <sup>(1)</sup> | \$   | 60,000   | 1         | Ea              | \$        | 60,000  |  |
| Bag Filters                              | \$   | 3,000    | 2         | Ea              | \$        | 6,000   |  |
| Valves                                   | \$   | 3,000    | 1         | Ea              | \$        | 3,000   |  |
| Instrumentation                          | \$   | 5,000    | 1         | Ea              | \$        | 5,000   |  |
| Piping                                   | \$   | 5,000    | 1         | Ea              | \$        | 5,000   |  |
| Booster Pump                             | \$   | 2,000    | 1         | Ea              | \$        | 2,000   |  |
| Flow Meter                               | \$   | 1,000    | 1         | Ea              | \$        | 1,000   |  |
| Contractor Labor Mechanical              | \$   | 10,000   | 1         | Ea              | \$        | 10,000  |  |
|  |      |          |           | System Subtotal | \$        | 99,000  |  |
| C-051B Wellhead Treatment Syster         | n (3 | 50 GPM)  |           |                 |           |         |  |
| Subgrade Preparation                     | \$   | 1,000    | 1         | Ea              | \$        | 1,000   |  |
| ABC Backfill                             | \$   | 7        | 65        | S.Y.            | \$        | 426     |  |
| Slab-on-Grade                            | \$   | 200      | 11        | C.Y.            | \$        | 2,200   |  |
| Rebar Reinforcement                      | \$   | 5,000    | 1         | Ea              | \$        | 5,000   |  |
| CMU WALL                                 | \$   | 15,000   | 1         | Ea              | \$        | 15,000  |  |
| Carbon System (2 Vessels)                | \$   | 170,000  | 1         | Ea              | \$        | 170,000 |  |
| Bag Filters                              | \$   | 15,000   | 2         | Ea              | \$        | 30,000  |  |
| Valves                                   | \$   | 10,000   | 1         | Ea              | \$        | 10,000  |  |
| Instrumentation                          | \$   | 10,000   | 1         | Ea              | \$        | 10,000  |  |
| Piping                                   | \$   | 10,000   | 1         | Ea              | \$        | 10,000  |  |
| Booster Pump                             | \$   | 2,000    | 1         | Ea              | \$        | 2,000   |  |
| Flow Meter                               | \$   | 2,000    | 1         | Ea              | \$        | 2,000   |  |
| Contractor Labor Mechanical              | \$   | 30,000   | 1         | Ea              | \$        | 30,000  |  |
| Electrical                               | \$   | 15,000   | 1         | Ea              | \$        | 15,000  |  |
|  |      |          |           | System Subtotal | \$        | 303,000 |  |

# Table F-2VOCs in WasteLess Aggressive Remedy Groundwater TreatmentCapital Costs

| ltem                             | E     | stimated<br>Unit<br>Cost | Estimated<br>Quantity | Units              |    | Total<br>stimated<br>Cost |
|----------------------------------|-------|--------------------------|-----------------------|--------------------|----|---------------------------|
| C-058B Wellhead Treatment System | n (45 | 50 GPM)                  |                       |                    |    |                           |
| Subgrade Preparation             | \$    | 1,000                    | 1                     | Ea                 |    | 1,000                     |
| ABC Backfill                     | \$    | 7                        | 67                    | S.Y.               | \$ | 439                       |
| Slab-on-Grade                    | \$    | 200                      | 11                    | C.Y.               | \$ | 2,200                     |
| Rebar Reinforcement              | \$    | 5,000                    | 1                     | Ea                 | \$ | 5,000                     |
| CMU WALL                         | \$    | 15,000                   | 1                     | Ea                 | \$ | 15,000                    |
| Carbon System (2 Vessels)        | \$    | 170,000                  | 1                     | Ea                 | \$ | 170,000                   |
| Bag Filters                      | \$    | 15,000                   | 2                     | Ea                 | \$ | 30,000                    |
| Valves                           | \$    | 10,000                   | 1                     | Ea                 | \$ | 10,000                    |
| Instrumentation                  | \$    | 10,000                   | 1                     | Ea                 | \$ | 10,000                    |
| Piping                           | \$    | 10,000                   | 1                     | Ea                 | \$ | 10,000                    |
| Booster Pump                     | \$    | 2,000                    | 1                     | Ea                 | \$ | 2,000                     |
| Flow Meter                       | \$    | 2,000                    | 1                     | Ea                 | \$ | 2,000                     |
| Contractor Labor Mechanical      | \$    | 30,000                   | 1                     | Ea                 | \$ | 30,000                    |
| Electrical                       | \$    | 15,000                   | 1                     | Ea                 | \$ | 15,000                    |
|                                  |       |                          |                       | System Subtotal    | \$ | 303,000                   |
| Perimeter Fencing                |       |                          |                       |                    |    |                           |
| Broadway North Landfill          | \$    | 44                       | 5300                  | L.F.               | \$ | 233,200                   |
| Broadway South Landfill          | \$    | 44                       | 6000                  | L.F.               | \$ | 264,000                   |
|                                  |       |                          |                       | Fencing Subtotal   | \$ | 497,200                   |
|                                  |       |                          |                       | Const. Subtotal    | \$ | 1,202,000                 |
| Contractor Markups               |       |                          |                       |                    |    |                           |
| Survey                           |       |                          | 2%                    | of Const. Subtotal | \$ | 24,000                    |
| QA/QC                            |       |                          | 4%                    | of Const. Subtotal | \$ | 48,000                    |
| Mobilization                     |       |                          | 8%                    | of Const. Subtotal | \$ | 96,000                    |
| General Conditions               |       |                          | 10%                   | of Const. Subtotal | \$ | 120,000                   |
|                                  |       |                          |                       | Const. Total       | \$ | 1,490,000                 |
| Engineering                      |       |                          | 6%                    | of Const. Total    | \$ | 89,000                    |
| Construction Management          |       |                          | 6%                    | of Const. Total    | \$ | 89,000                    |
|                                  |       |                          |                       | Total              | \$ | 1,668,000                 |

Notes:

- Costs are presented in 2016 US Dollars (\$US 2016) and total and subtotal costs are rounded to the nearest \$1,000

- The estimated unit costs presented are for planning purposed only, at the feasibility study level (-30% to +50%).

- The remedial approach and associated costs summarized here will be refined during the design and construction contracting phase.

- Costs were developed using 2016 RS Means and cost information from similar projects

(1) Includes initial granular activated carbon % - percent

Const. - ConstructionGPM - gallons per minuteC.Y.- cubic yardsQA/QC - quality assurance/quality controlEa - eachS.Y. - square yards

## Table F-3VOCs in WasteMore Aggressive Remedy Groundwater TreatmentCapital Costs

|                                       | E      | stimated    | Estimated |        |           | Total   |  |  |  |
|---------------------------------------|--------|-------------|-----------|--------|-----------|---------|--|--|--|
| Item                                  |        | Unit        | Ouantity  | Units  | Estimated |         |  |  |  |
|                                       |        | Cost        | Quantity  |        |           | Cost    |  |  |  |
| Extraction Well (EX-02) Installation  |        |             |           |        |           |         |  |  |  |
| Well Installation                     | \$     | 112,275     | 1         | Ea     | \$        | 112,275 |  |  |  |
| Pump and Pump Casing                  | \$     | 22,520      | 1         | Ea     | \$        | 22,520  |  |  |  |
| Well Development                      | \$     | 6,000       | 1         | Ea     | \$        | 6,000   |  |  |  |
| Pump Installation                     | \$     | 8,000       | 1         | Ea     | \$        | 8,000   |  |  |  |
| Electrical                            | \$     | 20,000      | 1         | Ea     | \$        | 20,000  |  |  |  |
| Vault                                 | \$     | 5,000       | 1         | Ea     | \$        | 5,000   |  |  |  |
| Wellhead Instrumentation              | \$     | 2,000       | 1         | Ea     | \$        | 2,000   |  |  |  |
| Flow Meter                            | \$     | 2,000       | 1         | Ea     | \$        | 2,000   |  |  |  |
| Wellhead Construction Costs           | \$     | 8,000       | 1         | Ea     | \$        | 8,000   |  |  |  |
| IDW and Site Security                 | \$     | 7,500       | 1         | Ea     | \$        | 7,500   |  |  |  |
| Extraction Well (EX-02) Conveyance P  | ipe Ir | nstallation |           |        |           |         |  |  |  |
| Excavation, Trench                    | \$     | 10          | 3,519     | B.C.Y. | \$        | 34,657  |  |  |  |
| Piping and Valves                     | \$     | 33          | 9,500     | L.F.   | \$        | 308,975 |  |  |  |
| ABC Backfill                          | \$     | 39          | 352       | CY     | \$        | 13,828  |  |  |  |
| Compaction                            | \$     | 2           | 3,519     | E.C.Y. | \$        | 8,726   |  |  |  |
| Asphalt Paving                        | \$     | 21          | 2111      | S.Y.   | \$        | 43,489  |  |  |  |
| Trench Plate                          | \$     | 5,000       | 1         | Ea     | \$        | 5,000   |  |  |  |
| Traffic Control                       | \$     | 10,000      | 1         | Ea     | \$        | 10,000  |  |  |  |
| Horizontal Boring - Broadway Rd.      | \$     | 457         | 200       | L.F.   | \$        | 91,500  |  |  |  |
| Horizontal Boring - Kolb Rd.          | \$     | 450         | 250       | L.F.   | \$        | 112,500 |  |  |  |
| Utility Conflicts                     | \$     | 5,000       | 30        | Ea     | \$        | 150,000 |  |  |  |
| Extraction Well (C-022A) Installation |        |             |           |        |           |         |  |  |  |
| Well Installation                     | \$     | 112,275     | 1         | Ea     | \$        | 112,275 |  |  |  |
| Pump and Pump Casing                  | \$     | 22,520      | 1         | Ea     | \$        | 22,520  |  |  |  |
| Well Development                      | \$     | 6,000       | 1         | Ea     | \$        | 6,000   |  |  |  |
| Pump Installation                     | \$     | 8,000       | 1         | Ea     | \$        | 8,000   |  |  |  |
| Electrical                            | \$     | 20,000      | 1         | Ea     | \$        | 20,000  |  |  |  |
| Vault                                 | \$     | 5,000       | 1         | Ea     | \$        | 5,000   |  |  |  |
| Wellhead Instrumentation              | \$     | 2,000       | 1         | Ea     | \$        | 2,000   |  |  |  |
| Flow Meter                            | \$     | 2,000       | 1         | Ea     | \$        | 2,000   |  |  |  |
| Wellhead Construction Costs           | \$     | 8,000       | 1         | Ea     | \$        | 8,000   |  |  |  |
| IDW and Site Security                 | \$     | 7,500       | 1         | Ea     | \$        | 7,500   |  |  |  |

# Table F-3VOCs in WasteMore Aggressive Remedy Groundwater TreatmentCapital Costs

|  | E     | stimated   | Estimated  |                       |    | Total    |
|--|-------|------------|------------|-----------------------|----|----------|
| Item                                   |       | Unit       | Ouantity   | Units                 | Es | stimated |
|  |       | Cost       | Quantity   |                       |    | Cost     |
| Extraction Well (C-022A) Pipeline Conr | necte | d to EX-02 | Conveyance | Pipeline Installation |    |          |
| Excavation, Trench                     | \$    | 10         | 1,667      | B.C.Y.                | \$ | 16,420   |
| Piping and Valves                      | \$    | 30         | 4,500      | L.F.                  | \$ | 136,300  |
| ABC Backfill                           | \$    | 39         | 167        | CY                    | \$ | 6,550    |
| Compaction                             | \$    | 2          | 1,667      | E.C.Y.                | \$ | 4,131    |
| Asphalt Paving                         | \$    | 21         | 1000       | S.Y.                  | \$ | 20,600   |
| Trench Plate                           | \$    | 5,000      | 1          | Ea                    | \$ | 5,000    |
| Traffic Control                        | \$    | 10,000     | 1          | Ea                    | \$ | 10,000   |
| Utility Conflicts                      | \$    | 5,000      | 10         | Ea                    | \$ | 50,000   |
| 411-P Wellhead Treatment System (750   | GPM)  |            |            |                       |    |          |
| Subgrade Preparation                   | \$    | 1,000      | 1          | Ea                    | \$ | 1,000    |
| ABC Backfill                           | \$    | 7          | 6          | S.Y.                  | \$ | 39       |
| Slab-on-Grade                          | \$    | 200        | 3          | C.Y.                  | \$ | 600      |
| Rebar Reinforcement                    | \$    | 300        | 1          | Ea                    | \$ | 300      |
| CMU Wall                               | \$    | 5,000      | 1          | Ea                    | \$ | 5,000    |
| Carbon Vessels                         | \$    | 60,000     | 1          | Ea                    | \$ | 60,000   |
| Bag Filters                            | \$    | 3,000      | 2          | Ea                    | \$ | 6,000    |
| Valves                                 | \$    | 3,000      | 1          | Ea                    | \$ | 3,000    |
| Instrumentation                        | \$    | 5,000      | 1          | Ea                    | \$ | 5,000    |
| Piping                                 | \$    | 5,000      | 1          | Ea                    | \$ | 5,000    |
| Booster Pump                           | \$    | 2,000      | 2          | Ea                    | \$ | 4,000    |
| Flow Meter                             | \$    | 1,000      | 1          | Ea                    | \$ | 1,000    |
| Contractor Labor Mechanical            | \$    | 10,000     | 1          | Ea                    | \$ | 10,000   |
| WCS System Modifications               |       |            |            |                       |    |          |
| Carbon Vessels                         | \$    | 320,000    | 2          | Ea                    | \$ | 640,000  |
| Bag Filters                            | \$    | 15,000     | 4          | Ea                    | \$ | 60,000   |
| Contractor Labor Mechanical            | \$    | 10,000     | 1          | Ea                    | \$ | 10,000   |
| Control System                         | \$    | 80,000     | 1          | Ea                    | \$ | 80,000   |
| Initial Fill of Carbon                 | \$    | 120,000    | 1          | Ea                    | \$ | 120,000  |
| Injection Well Rehabilitation          | \$    | 60,000     | 1          | Ea                    | \$ | 60,000   |

## Table F-3VOCs in WasteMore Aggressive Remedy Groundwater TreatmentCapital Costs

| ltem                    |    | timated<br>Unit<br>Cost | Estimated<br>Quantity | Units              | E  | Total<br>Stimated<br>Cost |
|-------------------------|----|-------------------------|-----------------------|--------------------|----|---------------------------|
| Perimeter Fencing       |    |                         |                       |                    |    |                           |
| Broadway North Landfill | \$ | 44                      | 5300                  | L.F.               | \$ | 233,000                   |
| Broadway South Landfill | \$ | 44                      | 6000                  | L.F.               | \$ | 264,000                   |
|                         |    |                         |                       | Fencing Subtotal   | \$ | 497,000                   |
|                         |    |                         |                       | Const. Subtotal    | \$ | 2,982,000                 |
| Contractor Markups      |    |                         |                       |                    |    |                           |
| Survey                  |    |                         | 2%                    | of Const. Subtotal | \$ | 60,000                    |
| QA/QC                   |    |                         | 4%                    | of Const. Subtotal | \$ | 119,000                   |
| Mobilization            |    |                         | 8%                    | of Const. Subtotal | \$ | 239,000                   |
| General Conditions      |    |                         | 10%                   | of Const. Subtotal | \$ | 298,000                   |
|                         |    |                         |                       | Const. Total       | \$ | 3,698,000                 |
| Engineering             |    |                         | 6%                    | of Const. Total    | \$ | 222,000                   |
| Construction Management |    |                         | 6%                    | of Const. Total    | \$ | 222,000                   |
|                         |    |                         |                       | Total              | \$ | 4,142,000                 |

Notes:

- Costs are presented in 2016 US Dollars (\$US 2016) and rounded to the nearest \$1,000

- The estimated unit costs presented are for planning purposed only, at the feasibility study level (-30% to +50%).

- The remedial approach and associated costs summarized here will be refined during the design and construction contracting phase.

- Costs were developed using 2016 RS Means and cost information from similar projects

-Capital Cost for 411-P Wellhead Treatment Occur in Year 2027

% - percent

B.C.Y. - bank cubic yards

C.Y. - cubic yards

CMU - concrete masonry unit

E.C.Y. - embankment cubic yards

Ea - each

GPM - gallons per minute

L.F. - linear feet

QA/QC - quality assurance/quality control

S.Y. - square yards

### Table F-4 VOCs in Waste Groundwater Treatment O&M and Lifecycle Costs

| Reference Remedy |    |                    |    | Less Aggressive Remedy  |    |                    | More Aggressive Remedy |                         |    |                    |    |                          |
|------------------|----|--------------------|----|-------------------------|----|--------------------|------------------------|-------------------------|----|--------------------|----|--------------------------|
| Year             |    | O&M <sup>(1)</sup> | Li | fe Cycle <sup>(2)</sup> |    | O&M <sup>(1)</sup> | Li                     | fe Cycle <sup>(2)</sup> |    | O&M <sup>(1)</sup> | Li | ife Cycle <sup>(2)</sup> |
| 2016             | \$ | -                  | \$ | 83,000                  | \$ | -                  | \$                     | 83,000                  | \$ | 162,000            | \$ | 94,000                   |
| 2017             | \$ | 1,000              | \$ | 90,000                  | \$ | 1,000              | \$                     | 90,000                  | \$ | 163,000            | \$ | 100,000                  |
| 2018             | \$ | 1,000              | \$ | 72,000                  | \$ | 1,000              | \$                     | 72,000                  | \$ | 163,000            | \$ | 83,000                   |
| 2019             | \$ | 1,000              | \$ | 90,000                  | \$ | 1,000              | \$                     | 90,000                  | \$ | 163,000            | \$ | 100,000                  |
| 2020             | \$ | 1,000              | \$ | 195,000                 | \$ | 1,000              | \$                     | 195,000                 | \$ | 163,000            | \$ | 205,000                  |
| 2021             | \$ | 1,000              | \$ | 90,000                  | \$ | 1,000              | \$                     | 90,000                  | \$ | 163,000            | \$ | 100,000                  |
| 2022             | \$ | 1,000              | \$ | 77,000                  | \$ | 1,000              | \$                     | 72,000                  | \$ | 163,000            | \$ | 83,000                   |
| 2023             | \$ | 68,000             | \$ | 95,000                  | \$ | 1,000              | \$                     | 95,000                  | \$ | 163,000            | \$ | 100,000                  |
| 2024             | \$ | 68,000             | \$ | 77,000                  | \$ | 68,000             | \$                     | 77,000                  | \$ | 163,000            | \$ | 83,000                   |
| 2025             | \$ | 68,000             | \$ | 312,000                 | \$ | 68,000             | \$                     | 312,000                 | \$ | 163,000            | \$ | 318,000                  |
| 2026             | \$ | 68,000             | \$ | 77,000                  | \$ | 68,000             | \$                     | 77,000                  | \$ | 162,000            | \$ | 83,000                   |
| 2027             | \$ | 68,000             | \$ | 95,000                  | \$ | 68,000             | \$                     | 95,000                  | \$ | 231,000            | \$ | 100,000                  |
| 2028             | \$ | 68,000             | \$ | 77,000                  | \$ | 68,000             | \$                     | 77,000                  | \$ | 230,000            | \$ | 83,000                   |
| 2029             | \$ | 68,000             | \$ | 95,000                  | \$ | 68,000             | \$                     | 95,000                  | \$ | 230,000            | \$ | 100,000                  |
| 2030             | \$ | 68,000             | \$ | 200,000                 | \$ | 68,000             | \$                     | 200,000                 | \$ | 230,000            | \$ | 205,000                  |
| 2031             | \$ | 68,000             | \$ | 95,000                  | \$ | 68,000             | \$                     | 95,000                  | \$ | 201,000            | \$ | 100,000                  |
| 2032             | \$ | 68,000             | \$ | 77,000                  | \$ | 68,000             | \$                     | 77,000                  | \$ | 201,000            | \$ | 82,000                   |
| 2033             | \$ | 68,000             | \$ | 95,000                  | \$ | 68,000             | \$                     | 95,000                  | \$ | 200,000            | \$ | 100,000                  |
| 2034             | \$ | 68,000             | \$ | 77,000                  | \$ | 68,000             | \$                     | 77,000                  | \$ | 200,000            | \$ | 82,000                   |
| 2035             | \$ | 68,000             | \$ | 312,000                 | \$ | 68,000             | \$                     | 312,000                 | \$ | 284,000            | \$ | 317,000                  |
| 2036             | \$ | 68,000             | \$ | 77,000                  | \$ | 68,000             | \$                     | 77,000                  | \$ | 215,000            | \$ | 82,000                   |
| 2037             | \$ | 68,000             | \$ | 95,000                  | \$ | 68,000             | \$                     | 95,000                  | \$ | 214,000            | \$ | 100,000                  |
| 2038             | \$ | 68,000             | \$ | 77,000                  | \$ | 68,000             | \$                     | 77,000                  | \$ | 213,000            | \$ | 82,000                   |
| 2039             | \$ | 68,000             | \$ | 95,000                  | \$ | 68,000             | \$                     | 95,000                  | \$ | 212,000            | \$ | 100,000                  |
| 2040             | \$ | 68,000             | \$ | 200,000                 | \$ | 68,000             | \$                     | 200,000                 | \$ | 212,000            | \$ | 205,000                  |
| 2041             | \$ | 68,000             | \$ | 95,000                  | \$ | 68,000             | \$                     | 95,000                  | \$ | 211,000            | \$ | 100,000                  |
| 2042             | \$ | 68,000             | \$ | 77,000                  | \$ | 68,000             | \$                     | 77,000                  | \$ | 211,000            | \$ | 82,000                   |
| 2043             | \$ | 68,000             | \$ | 95,000                  | \$ | 68,000             | \$                     | 95,000                  | \$ | 210,000            | \$ | 100,000                  |
| 2044             | \$ | 68,000             | \$ | 77,000                  | \$ | 68,000             | \$                     | 77,000                  | \$ | 210,000            | \$ | 1,529,000                |
| 2045             | \$ | 68,000             | \$ | 287,000                 | \$ | 68,000             | \$                     | 287,000                 | \$ | 1,000              | \$ | -                        |
| 2046             | \$ | 68,000             | \$ | 72,000                  | \$ | 68,000             | \$                     | 72,000                  | \$ | 1,000              | \$ | -                        |
| 2047             | \$ | 67,000             | \$ | 72,000                  | \$ | 67,000             | \$                     | 72,000                  | \$ | -                  | \$ | -                        |
| 2048             | \$ | 67,000             | \$ | 72,000                  | \$ | 67,000             | \$                     | 72,000                  | \$ | -                  | \$ | -                        |
| 2049             | \$ | 67,000             | \$ | 72,000                  | \$ | 67,000             | \$                     | 72,000                  | \$ | -                  | \$ | -                        |
| 2050             | \$ | 67,000             | \$ | 192,000                 | \$ | 67,000             | \$                     | 192,000                 | \$ | -                  | \$ | -                        |
| 2051             | \$ | 67,000             | \$ | 72,000                  | \$ | 67,000             | \$                     | 72,000                  | \$ | -                  | \$ | -                        |
| 2052             | \$ | 67,000             | \$ | 72,000                  | \$ | 67,000             | \$                     | 72,000                  | \$ | -                  | \$ | -                        |
| 2053             | \$ | 67,000             | \$ | 72,000                  | \$ | 68,000             | \$                     | 72,000                  | \$ | -                  | \$ | -                        |
| 2054             | \$ | 67,000             | \$ | 72,000                  | \$ | 68,000             | \$                     | 72,000                  | \$ | -                  | \$ | -                        |
| 2055             | \$ | 67,000             | \$ | 287,000                 | \$ | 68,000             | \$                     | 287,000                 | \$ | -                  | \$ | -                        |
| 2056             | \$ | 67,000             | \$ | 72,000                  | \$ | 68,000             | \$                     | 72,000                  | \$ | -                  | \$ | -                        |
| 2057             | \$ | 67,000             | \$ | 72,000                  | \$ | 68,000             | \$                     | 72,000                  | \$ | -                  | \$ | -                        |
| 2058             | \$ | 67,000             | \$ | 72,000                  | \$ | 68,000             | \$                     | 72,000                  | \$ | -                  | \$ | -                        |

### Table F-4 VOCs in Waste Groundwater Treatment O&M and Lifecycle Costs

| N    | Reference          | e R | emedy                  | Less Aggres        | ggressive Remedy More Aggressive Re |                         |    | emedy              |        |                     |
|------|--------------------|-----|------------------------|--------------------|-------------------------------------|-------------------------|----|--------------------|--------|---------------------|
| rear | O&M <sup>(1)</sup> | Lif | e Cycle <sup>(2)</sup> | O&M <sup>(1)</sup> | Li                                  | fe Cycle <sup>(2)</sup> |    | O&M <sup>(1)</sup> | Life C | ycle <sup>(2)</sup> |
| 2059 | \$<br>67,000       | \$  | 72,000                 | \$<br>67,000       | \$                                  | 72,000                  | \$ | -                  | \$     | -                   |
| 2060 | \$<br>67,000       | \$  | 192,000                | \$<br>67,000       | \$                                  | 192,000                 | \$ | -                  | \$     | -                   |
| 2061 | \$<br>67,000       | \$  | 72,000                 | \$<br>67,000       | \$                                  | 72,000                  | \$ | -                  | \$     | -                   |
| 2062 | \$<br>-            | \$  | 67,000                 | \$<br>67,000       | \$                                  | 72,000                  | \$ | -                  | \$     | -                   |
| 2063 | \$<br>-            | \$  | 67,000                 | \$<br>67,000       | \$                                  | 72,000                  | \$ | -                  | \$     | -                   |
| 2064 | \$<br>-            | \$  | 67,000                 | \$<br>67,000       | \$                                  | 72,000                  | \$ | -                  | \$     | -                   |
| 2065 | \$<br>-            | \$  | 257,000                | \$<br>67,000       | \$                                  | 262,000                 | \$ | -                  | \$     | -                   |
| 2066 | \$<br>-            | \$  | 45,000                 | \$<br>67,000       | \$                                  | 50,000                  | \$ | -                  | \$     | -                   |
| 2067 | \$<br>-            | \$  | 45,000                 | \$<br>67,000       | \$                                  | 50,000                  | \$ | -                  | \$     | -                   |
| 2068 | \$<br>-            | \$  | 45,000                 | \$<br>67,000       | \$                                  | 50,000                  | \$ | -                  | \$     | -                   |
| 2069 | \$<br>-            | \$  | 45,000                 | \$<br>-            | \$                                  | 45,000                  | \$ | -                  | \$     | -                   |
| 2070 | \$<br>-            | \$  | 162,000                | \$<br>-            | \$                                  | 162,000                 | \$ | -                  | \$     | -                   |
| 2071 | \$<br>-            | \$  | 45,000                 | \$<br>-            | \$                                  | 45,000                  | \$ | -                  | \$     | -                   |
| 2072 | \$<br>-            | \$  | 45,000                 | \$<br>-            | \$                                  | 45,000                  | \$ | -                  | \$     | -                   |
| 2073 | \$<br>-            | \$  | 45,000                 | \$<br>-            | \$                                  | 45,000                  | \$ | -                  | \$     | -                   |
| 2074 | \$<br>-            | \$  | 45,000                 | \$<br>-            | \$                                  | 45,000                  | \$ | -                  | \$     | -                   |
| 2075 | \$<br>-            | \$  | 257,000                | \$<br>-            | \$                                  | 257,000                 | \$ | -                  | \$     | -                   |
| 2076 | \$<br>-            | \$  | 45,000                 | \$<br>-            | \$                                  | 45,000                  | \$ | -                  | \$     | -                   |
| 2077 | \$<br>-            | \$  | 45,000                 | \$<br>-            | \$                                  | 45,000                  | \$ | -                  | \$     | -                   |
| 2078 | \$<br>-            | \$  | 45,000                 | \$<br>-            | \$                                  | 45,000                  | \$ | -                  | \$     | -                   |
| 2079 | \$<br>-            | \$  | 45,000                 | \$<br>-            | \$                                  | 45,000                  | \$ | -                  | \$     | -                   |
| 2080 | \$<br>-            | \$  | 162,000                | \$<br>-            | \$                                  | 162,000                 | \$ | -                  | \$     | -                   |
| 2081 | \$<br>-            | \$  | 45,000                 | \$<br>-            | \$                                  | 45,000                  | \$ | -                  | \$     | -                   |
| 2082 | \$<br>-            | \$  | 45,000                 | \$<br>-            | \$                                  | 45,000                  | \$ | -                  | \$     | -                   |
| 2083 | \$<br>-            | \$  | 45,000                 | \$<br>-            | \$                                  | 45,000                  | \$ | -                  | \$     | -                   |
| 2084 | \$<br>-            | \$  | 45,000                 | \$<br>-            | \$                                  | 45,000                  | \$ | -                  | \$     | -                   |
| 2085 | \$<br>-            | \$  | 257,000                | \$<br>79,000       | \$                                  | 257,000                 | \$ | -                  | \$     | -                   |
| 2086 | \$<br>-            | \$  | 45,000                 | \$<br>79,000       | \$                                  | 45,000                  | \$ | -                  | \$     | -                   |
| 2087 | \$<br>-            | \$  | 45,000                 | \$<br>79,000       | \$                                  | 45,000                  | \$ | -                  | \$     | -                   |
| 2088 | \$<br>-            | \$  | 45,000                 | \$<br>79,000       | \$                                  | 45,000                  | \$ | -                  | \$     | -                   |
| 2089 | \$<br>-            | \$  | 45,000                 | \$<br>79,000       | \$                                  | 45,000                  | \$ | -                  | \$     | -                   |
| 2090 | \$<br>-            | \$  | 162,000                | \$<br>79,000       | \$                                  | 162,000                 | \$ | -                  | \$     | -                   |
| 2091 | \$<br>-            | \$  | 45,000                 | \$<br>79,000       | \$                                  | 45,000                  | \$ | -                  | \$     | -                   |
| 2092 | \$<br>-            | \$  | 45,000                 | \$<br>79,000       | \$                                  | 45,000                  | \$ | -                  | \$     | -                   |
| 2093 | \$<br>-            | \$  | 45,000                 | \$<br>79,000       | \$                                  | 45,000                  | \$ | -                  | \$     | -                   |
| 2094 | \$<br>-            | \$  | 45,000                 | \$<br>144,000      | \$                                  | 45,000                  | \$ | -                  | \$     | -                   |
| 2095 | \$<br>65,000       | \$  | 257,000                | \$<br>144,000      | \$                                  | 257,000                 | \$ | -                  | \$     | -                   |
| 2096 | \$<br>141,000      | \$  | 45,000                 | \$<br>221,000      | \$                                  | 45,000                  | \$ | -                  | \$     | -                   |
| 2097 | \$<br>141,000      | \$  | 45,000                 | \$<br>221,000      | \$                                  | 45,000                  | \$ | -                  | \$     | -                   |
| 2098 | \$<br>142,000      | \$  | 45,000                 | \$<br>351,000      | \$                                  | 45,000                  | \$ | -                  | \$     | -                   |
| 2099 | \$<br>206,000      | \$  | 45,000                 | \$<br>351,000      | \$                                  | 45,000                  | \$ | -                  | \$     | -                   |
| 2100 | \$<br>207,000      | \$  | 162,000                | \$<br>351,000      | \$                                  | 162,000                 | \$ | -                  | \$     | -                   |
| 2101 | \$<br>207,000      | \$  | 45,000                 | \$<br>351,000      | \$                                  | 45,000                  | \$ | -                  | \$     | -                   |

| Table F-4               |
|-------------------------|
| VOCs in Waste           |
| Groundwater Treatment   |
| O&M and Lifecycle Costs |

| Veer  | Reference Remedy |                    |    |                         |    |                    | siv | e Remedy                 | More Aggressive Remedy |                    |                           |           |
|-------|------------------|--------------------|----|-------------------------|----|--------------------|-----|--------------------------|------------------------|--------------------|---------------------------|-----------|
| rear  |                  | O&M <sup>(1)</sup> | Li | fe Cycle <sup>(2)</sup> |    | O&M <sup>(1)</sup> | L   | ife Cycle <sup>(2)</sup> |                        | O&M <sup>(1)</sup> | Life Cycle <sup>(2)</sup> |           |
| 2102  | \$               | 207,000            | \$ | 45,000                  | \$ | 351,000            | \$  | 45,000                   | \$                     | -                  | \$                        | -         |
| 2103  | \$               | 207,000            | \$ | 45,000                  | \$ | 351,000            | \$  | 45,000                   | \$                     | -                  | \$                        | -         |
| 2104  | \$               | 207,000            | \$ | 45,000                  | \$ | 351,000            | \$  | 45,000                   | \$                     | -                  | \$                        | -         |
| 2105  | \$               | 207,000            | \$ | 257,000                 | \$ | 351,000            | \$  | 257,000                  | \$                     | -                  | \$                        | -         |
| 2106  | \$               | 207,000            | \$ | 45,000                  | \$ | 351,000            | \$  | 45,000                   | \$                     | -                  | \$                        | -         |
| 2107  | \$               | 207,000            | \$ | 45,000                  | \$ | 351,000            | \$  | 45,000                   | \$                     | -                  | \$                        | -         |
| 2108  | \$               | 207,000            | \$ | 45,000                  | \$ | 351,000            | \$  | 45,000                   | \$                     | -                  | \$                        | -         |
| 2109  | \$               | 142,000            | \$ | 45,000                  | \$ | 286,000            | \$  | 45,000                   | \$                     | -                  | \$                        | -         |
| 2110  | \$               | 142,000            | \$ | 162,000                 | \$ | 286,000            | \$  | 162,000                  | \$                     | -                  | \$                        | -         |
| 2111  | \$               | 142,000            | \$ | 45,000                  | \$ | 286,000            | \$  | 45,000                   | \$                     | -                  | \$                        | -         |
| 2112  | \$               | 142,000            | \$ | 45,000                  | \$ | 286,000            | \$  | 45,000                   | \$                     | -                  | \$                        | -         |
| 2113  | \$               | 142,000            | \$ | 45,000                  | \$ | 286,000            | \$  | 45,000                   | \$                     | -                  | \$                        | -         |
| 2114  | \$               | 142,000            | \$ | 45,000                  | \$ | 286,000            | \$  | 45,000                   | \$                     | -                  | \$                        | -         |
| 2115  | \$               | 142,000            | \$ | 651,000                 | \$ | 286,000            | \$  | 651,000                  | \$                     | -                  | \$                        | -         |
| Total | \$               | 6,195,000          | \$ | 9,910,000               | \$ | 10,355,000         | \$  | 9,940,000                | \$                     | 5,708,000          | \$                        | 4,898,000 |

Notes:

- Costs are presented in 2016 US Dollars (\$US 2016)

- The estimated unit costs presented are for planning purposed only, at the feasibility study level (-30% to +50%).

- The remedial approach and associated costs summarized here will be refined during the design and construction contracting phase. O&M - operations and maintenance

<sup>(1)</sup> O&M costs include system operations personnel, cleaning and mechanical maintenance, materials, and operations utility costs at \$0.14/kW/Hr.

<sup>(2)</sup> Lifecycle costs include monitoring, reporting, well installation, and well abandonments

### Table F-5 VOCs in Waste Soil Vapor Extraction (SVE) Capital Costs

| Item                                     | E  | stimated<br>Unit<br>Cost | Estimated<br>Quantity | Units       | Es | Total<br>stimated<br>Cost |
|--|----|--------------------------|-----------------------|-------------|----|---------------------------|
| Well Installation                        |    |                          |                       |             |    |                           |
| SVE Extraction Well Installation (EX-01) | \$ | 120                      | 300                   | L.F.        | \$ | 36,000                    |
| SVE Extraction Well Installation (EX-02) | \$ | 120                      | 375                   | L.F.        | \$ | 45,000                    |
| SVE Monitoring Well Installation (MW-01) | \$ | 120                      | 300                   | L.F.        | \$ | 36,000                    |
| SVE Monitoring Well Installation (MW-02) | \$ | 120                      | 300                   | L.F.        | \$ | 36,000                    |
| System Installation                      |    |                          |                       |             |    |                           |
| Slab                                     | \$ | 200                      | 11                    | C.Y.        | \$ | 2,200                     |
| Subgrade Preparation                     | \$ | 1,000                    | 1                     | Ea          | \$ | 1,000                     |
| ABC Backfill                             | \$ | 7                        | 67                    | S.Y.        | \$ | 439                       |
| Electrical                               | \$ | 15,000                   | 1                     | Ea          | \$ | 15,000                    |
| Misc. Piping/Equipment                   | \$ | 10,000                   | 1                     | Ea          | \$ | 10,000                    |
| Piping                                   | \$ | 15                       | 1,300                 | L.F.        | \$ | 19,500                    |
| Equipment Rental                         | \$ | 1,667                    | 12                    | Months      | \$ | 20,000                    |
| Labor                                    |    |                          |                       |             |    |                           |
| Labor                                    | \$ | 50                       | 480                   | hrs         | \$ | 24,000                    |
|  |    |                          |                       | Subtotal    | ¢  | 245.000                   |
| Contractor Markups                       |    |                          |                       | Subiolai    | φ  | 245,000                   |
| Survey                                   |    |                          | 2%                    | of Subtotal | \$ | 4 900                     |
| QA/QC                                    |    |                          | 4%                    | of Subtotal | \$ | 9.800                     |
| Mobilization                             |    |                          | 8%                    | of Subtotal | \$ | 19.600                    |
| General Conditions                       |    |                          | 10%                   | of Subtotal | \$ | 24,500                    |
|  |    |                          |                       | Subtotal    | \$ | 304,000                   |
| Engineering                              |    |                          | 6%                    | of Subtotal | \$ | 18,240                    |
| Construction Management                  |    |                          | 6%                    | of Subtotal | \$ | 18,240                    |
|  |    |                          |                       | Total       | \$ | 340,000                   |

Notes:

- Costs are presented in 2016 US Dollars (\$US 2016)

- The estimated unit costs presented are for planning purposed only, at the feasibility study level (-30% to +50%).

- The remedial approach and associated costs summarized here will be refined during the design and construction contracting phase.

- Costs were developed using 2016 RS Means and cost information from similar projects

% - percent

C.Y. - cubic yards

Ea - each

L.F. - linear feet

Misc. - Miscellaneous

QA/QC - quality assurance/quality control

SVE - soil vapor extraction

S.Y. - square yards

| Tear  |    |         |    | Life Cycle |  |  |  |
|-------|----|---------|----|------------|--|--|--|
| 2016  | \$ | -       | \$ | 168,000    |  |  |  |
| 2017  | \$ | 200,000 | \$ | 154,000    |  |  |  |
| 2018  | \$ | -       | \$ | 70,000     |  |  |  |
| 2019  | \$ | -       | \$ | 37,000     |  |  |  |
| 2020  | \$ | -       | \$ | 37,000     |  |  |  |
| 2021  | \$ | -       | \$ | -          |  |  |  |
| 2022  | \$ | -       | \$ | 5,000      |  |  |  |
| 2023  | \$ | -       | \$ | 33,000     |  |  |  |
| 2024  | \$ | -       | \$ | -          |  |  |  |
| 2025  | \$ | -       | \$ | 28,000     |  |  |  |
| 2026  | \$ | -       | \$ | -          |  |  |  |
| 2027  | \$ | -       | \$ | -          |  |  |  |
| 2028  | \$ | -       | \$ | 25,000     |  |  |  |
| 2029  | \$ | -       | \$ | -          |  |  |  |
| 2030  | \$ | -       | \$ | 28,000     |  |  |  |
| 2031  | \$ | -       | \$ | -          |  |  |  |
| 2032  | \$ | -       | \$ | -          |  |  |  |
| 2033  | \$ | -       | \$ | 745,000    |  |  |  |
| 2034  | \$ | -       | \$ | -          |  |  |  |
| 2035  | \$ | -       | \$ | 388,000    |  |  |  |
| Total | \$ | 200,000 | \$ | 1,718,000  |  |  |  |

## Table F-6VOCs in WasteSoil Vapor Extraction (SVE)O&M and Lifecycle Costs

### Notes:

- Costs are presented in 2016 US Dollars (\$US 2016)

- The estimated unit costs presented are for planning purposed only, at the feasibility study level (-30% to +50%).

- The remedial approach and associated costs summarized here will be refined during the design and construction contracting phase.

O&M - operation and maintenance

<sup>(1)</sup> O&M costs include system operations personnel, cleaning and mechanical maintenance, materials, and operations utility costs at \$0.14/kW/Hr.

 $^{\mbox{(2)}}$  Lifecycle costs include monitoring, reporting, well installation, and well abandonments

### Table F-7 VOCs in Waste In Situ Chemical Oxidation (ISCO) Capital Costs

| Item                          | Estimated<br>Unit<br>Cost |         | Units | Total<br>Estimated<br>Cost |               |
|-------------------------------|---------------------------|---------|-------|----------------------------|---------------|
| Well Installation             |                           |         |       |                            |               |
| Well Installation             | \$                        | 41,000  | 5     | Ea                         | \$<br>205,000 |
| Extraction Well Pump and Pipe | \$                        | 10,942  | 3     | Ea                         | \$<br>32,826  |
| System Installation           | -                         |         |       |                            |               |
| Transfer Pump                 | \$                        | 1,000   | 1     | Ea                         | \$<br>1,000   |
| Equipment                     | \$                        | 6,000   | 1     | Misc.                      | \$<br>6,000   |
| Valves/Fittings               | \$                        | 51,228  | 1     | Misc.                      | \$<br>51,228  |
| Pipe Trench Excavation        | \$                        | 9.85    | 300   | B.C.Y.                     | \$<br>2,955   |
| Pipe Trench Compaction        | \$                        | 2.48    | 375   | E.C.Y.                     | \$<br>930     |
| Electrical Service            | \$                        | 123,239 | 1     | Misc.                      | \$<br>123,239 |
| Electrical Trench Excavation  | \$                        | 9.85    | 450   | B.C.Y.                     | \$<br>4,433   |
| Electrical Trench Compaction  | \$                        | 2.48    | 563   | E.C.Y.                     | \$<br>1,396   |
| Electrical Controls           | \$                        | 20,000  | 1     | Ea                         | \$<br>20,000  |
| Tanks                         | \$                        | 6,650   | 2     | Ea                         | \$<br>13,300  |
| Meters                        | \$                        | 500     | 5     | Ea                         | \$<br>2,500   |
| Slab Installation             | \$                        | 507     | 27    | C.Y.                       | \$<br>13,695  |
| Secondary Containment         | \$                        | 482     | 5     | C.Y.                       | \$<br>2,412   |
| System Compound               | \$                        | 15.50   | 1400  | S.F.                       | \$<br>21,695  |
| Labor                         |                           |         |       |                            |               |
| Labor                         | \$                        | 55      | 600   | hrs                        | \$<br>33,000  |
|                               |                           |         |       | Subtotal                   | \$<br>536,000 |
| Construction Markups          |                           |         |       |                            |               |
| Survey                        |                           |         | 2%    | of Subtotal                | \$<br>10,720  |
| QA/QC                         |                           |         | 4%    | of Subtotal                | \$<br>21,440  |
| Mobilization                  | 8%                        |         |       | of Subtotal                | \$<br>42,880  |
| General Conditions            |                           |         | 10%   | of Subtotal                | \$<br>53,600  |
|                               | 1                         |         |       | Subtotal                   | \$<br>665,000 |
| Engineering                   |                           |         | 6%    | of Subtotal                | \$<br>39,900  |
|                               |                           |         | 6%    | of Subtotal                | \$<br>39,900  |
|                               |                           |         |       | Total                      | \$<br>745,000 |

Notes:

- Costs are presented in 2016 US Dollars (\$US 2016)

- The estimated unit costs presented are for planning purposed only, at the feasibility study level (-30% to +50%).

- The remedial approach and associated costs summarized here will be refined during the design and construction contracting phase.

- Costs were developed using 2016 RS Means and cost information from similar projects

% - percent

B.C.Y. - banked cubic yards

C.Y. - cubic yards

Ea - each

E.C.Y - embankment cubic yards

hrs - hours

Misc. - Miscellaneous

S.F. - square feet

| Table F-8                         |
|-----------------------------------|
| VOCs in Waste                     |
| In Situ Chemical Oxidation (ISCO) |
| O&M and Lifecycle Costs           |

| Year             | O&M |           |    | Life Cycle |
|------------------|-----|-----------|----|------------|
| 2016             | \$  | -         | \$ | -          |
| 2017             | \$  | 176,000   | \$ | 15,000     |
| 2018             | \$  | 176,000   | \$ | 15,000     |
| 2019             | \$  | 176,000   | \$ | 15,000     |
| 2020             | \$  | 176,000   | \$ | 15,000     |
| 2021             | \$  | 176,000   | \$ | 15,000     |
| 2022             | \$  | 176,000   | \$ | 15,000     |
| 2023             | \$  | 176,000   | \$ | 40,000     |
| <b>T</b> - 4 - 1 | 6   | 4 000 000 | ¢  | 120.000    |
| lotal            | \$  | 1,232,000 | \$ | 130,000    |

Note:

- Costs are presented in 2016 US Dollars (\$US 2016)

- The estimated unit costs presented are for planning purposed only, at the feasibility study level (-30% to +50%).

- The remedial approach and associated costs summarized here will be refined during the design and construction contracting phase.

O&M - operation and maintenance

 $^{(1)}$  O&M costs include system operations personnel, cleaning and mechanical maintenance, materials, and operations utility costs at \$0.14/kW/Hr.

 $^{\left(2\right)}$  Lifecycle costs include monitoring, reporting, well installation, and well abandonments

### **Remedy Costs Including Inflation** 3% Annual Inflation Reference Less Aggressive More Aggressive Year \$US 2016 3% Inf. \$US 2016 3% Inf. \$US 2016 3% Inf. 942,000 \$ 942,000 \$ 942,000 \$ 942,000 4,426,000 \$ 4,426,000 2016 \$ \$ \$ 1,716,000 2017 \$ 1,769,000 \$ 781,000 \$ 805,000 \$ 1,888,000 \$ 1,945,000 \$ 2018 335.000 \$ 355.000 \$ 143.000 \$ 151.000 \$ 507.000 \$ 538.000 537,000 2019 \$ 319,000 \$ 348,000 \$ 128,000 \$ 157,000 \$ 491,000 \$ 2020 \$ 424,000 477,000 \$ 233,000 \$ 261,000 \$ 596,000 \$ 671,000 \$ 2021 \$ 282,000 \$ 327,000 \$ 91,000 \$ 123,000 \$ 454,000 \$ 527,000 \$ \$ \$ 2022 274,000 \$ 328,000 \$ 78,000 92,000 \$ 442,000 528,000 2023 \$ 550,000 \$ 676,000 \$ 129,000 \$ 158,000 \$ 513,000 \$ 631,000 2024 \$ 145,000 184,000 \$ 283,000 \$ 357,000 246,000 \$ 311,000 \$ \$ \$ 2025 409,000 \$ 533,000 \$ 409,000 \$ 532,000 \$ 509,000 \$ 664,000 \$ \$ 145,000 \$ \$ 2026 145,000 \$ 195,000 \$ 194,000 245,000 329,000 2027 \$ 163,000 \$ 225,000 \$ 163,000 \$ 224,000 \$ 468,000 \$ 648,000 \$ 2028 171,000 \$ 243,000 \$ 171,000 \$ 242,000 \$ 338,000 \$ 483,000 2029 \$ 163,000 \$ 239,000 \$ 163,000 \$ \$ 331,000 \$ 485,000 238,000 2030 \$ 296.000 448.000 \$ 296,000 \$ 447.000 \$ 463.000 \$ 700.000 \$ 2031 \$ 163,000 \$ 254,000 \$ 163,000 \$ 252,000 \$ 301,000 \$ 468,000 \$ 145,000 233,000 145,000 \$ 2032 \$ \$ \$ 232,000 \$ 283,000 454,000 1,499,000 2033 \$ 908,000 \$ 1,501,000 \$ 908,000 \$ \$ 1,045,000 \$ 1,728,000 \$ \$ \$ \$ 2034 145,000 \$ 248,000 145,000 246,000 \$ 282,000 480,000 \$ 769.000 \$ 769.000 \$ 1,347,000 \$ 1,735,000 2035 \$ 1,348,000 \$ 989.000 \$ \$ 2036 145,000 \$ 263,000 \$ 145,000 \$ 261,000 \$ 297,000 536,000 2037 \$ 163,000 303,000 \$ 163,000 \$ 301,000 313,000 \$ 583,000 \$ \$ \$ 145,000 \$ \$ 2038 145.000 \$ 279.000 \$ 277,000 \$ 295.000 566,000 2039 \$ 163,000 322,000 \$ 163,000 \$ \$ 312,000 \$ 616,000 \$ 320,000 2040 \$ 268.000 \$ 545.000 \$ 268.000 \$ 543,000 \$ 416.000 \$ 846,000 \$ 2041 163,000 \$ 341,000 \$ 163,000 \$ 339,000 \$ 311,000 \$ 651,000 \$ 2042 145,000 314,000 \$ 145,000 \$ 312,000 \$ 293,000 \$ 631,000 \$ 2043 \$ 163,000 362,000 163,000 \$ 688,000 \$ \$ \$ 360,000 \$ 310,000 \$ \$ \$ \$ 2044 145,000 \$ 333,000 146,000 331,000 \$ 1,738,000 3,977,000 \$ 837,000 355,000 \$ 2045 355,000 \$ \$ \$ 835,000 \$ 1,000 2,000 2046 \$ 141,000 \$ 341,000 \$ 141,000 \$ 339,000 \$ 1,000 \$ 2,000 \$ \$ 2047 140,000 \$ 140,000 \$ \$ \$ 349,000 349,000 --\$ 360,000 \$ \$ 2048 140.000 \$ 360.000 \$ 140.000 \$ --\$ 2049 \$ 140,000 \$ 370,000 \$ 140,000 \$ 371,000 \$ \_ \_ \$ 2050 \$ 259,000 709,000 260,000 709,000 \$ \$ \$ \$ --\$ 140,000 \$ 2051 \$ 140,000 \$ 393,000 \$ \$ 393,000 \_ \$ \$ 2052 140,000 \$ 405,000 \$ 140,000 \$ 405,000 \$ --\$ \$ 2053 140.000 \$ 417.000 \$ 140,000 \$ 418,000 \$ --140,000 430,000 \$ \$ \$ 2054 140,000 \$ 429,000 \$ \$ \_ \_ 2055 \$ 354,000 \$ 1,122,000 \$ 355,000 \$ 1,123,000 \$ \$ --\$ \$ 2056 140,000 \$ 455,000 \$ 140,000 \$ 456,000 \$ \_ \_ \$ \$ 140,000 469,000 \$ 140,000 \$ \$ 2057 \$ 470,000 --

### Table F-9 **VOCs in Waste**

\$

140,000

\$

483.000

\$

2058

140.000

\$

484.000

\$

-

\$

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### 3% Annual Inflation Reference Less Aggressive More Aggressive Year \$US 2016 3% Inf. \$US 2016 3% Inf. **\$US 2016** 3% Inf. 499,000 \$ 139,000 497,000 \$ 140,000 2059 \$ \$ \$ \$ --\$ \$ 2060 259,000 \$ 952,000 \$ 260,000 \$ 953,000 \$ \_ \$ \$ 2061 139.000 \$ 527.000 \$ 140.000 \$ 529.000 \$ --\$ 2062 \$ 67,000 \$ 262,000 \$ 140,000 \$ 544,000 \$ --\$ \$ 2063 67,000 270,000 \$ 140,000 \$ 560,000 \$ \$ \$ 2064 \$ 67,000 \$ 278,000 \$ 140,000 \$ 577,000 \$ -\_ \$ \$ \$ \$ 2065 257,000 \$ 1,094,000 \$ 329,000 1,401,000 --\$ 2066 \$ 45,000 \$ 197,000 \$ 117,000 \$ 513,000 \$ \_ \_ 2067 \$ 45,000 203,000 \$ 117,000 528,000 \$ \$ \$ \$ --2068 \$ \$ 45,000 \$ 209,000 \$ 117,000 \$ 544,000 \$ \_ \_ \$ \$ \$ \$ 2069 45,000 \$ 215,000 45,000 \$ 215,000 --2070 \$ 162,000 \$ 799,000 \$ 162,000 \$ 799,000 \$ \$ -\_ \$ \$ 2071 45,000 \$ 228,000 \$ 45,000 \$ 228,000 \$ -\_ 2072 \$ 45,000 \$ 235,000 \$ 45,000 \$ \$ \$ 235,000 --\$ 2073 \$ 45.000 242.000 45.000 \$ 242,000 \$ \$ \$ \$ 2074 \$ 45,000 \$ 249,000 \$ 45,000 \$ 249,000 \$ \_ \_ 2075 \$ 257,000 1,470,000 257,000 1,470,000 \$ \$ \$ \$ \$ --2076 \$ 45,000 \$ 265,000 \$ 45,000 \$ 265,000 \$ \$ \_ \$ \$ \$ \$ \$ 2077 45,000 \$ 272,000 45,000 272,000 --\$ \$ 45.000 \$ \$ \$ 2078 45,000 \$ 281,000 281,000 \_ -\$ \$ \$ 2079 45,000 \$ 289,000 \$ 45,000 \$ 289,000 \_ \_ 2080 \$ 162,000 1,073,000 \$ 162,000 \$ 1,073,000 \$ \$ \$ \_ \_ \$ \$ \$ 2081 45.000 \$ 307,000 \$ 45.000 307,000 \$ \_ -\$ 45,000 \$ \$ 45,000 \$ \$ \$ 2082 316,000 316,000 --\$ 2083 \$ 45.000 \$ 325,000 \$ 45.000 \$ 325,000 \$ --\$ \$ 2084 45,000 \$ 335,000 \$ 45,000 \$ 335,000 \$ \_ -\$ 2085 \$ 257,000 1,975,000 \$ 756,000 \$ 5,815,000 \$ \$ --2086 \$ 45,000 355,000 124,000 983,000 \$ \$ \$ \$ \$ \_ \$ \$ \$ 2087 45,000 \$ 366,000 \$ 124,000 \$ 1,013,000 --\$ \$ 2088 45,000 \$ 377,000 \$ 124,000 \$ 1,044,000 \$ --2089 \$ 45,000 \$ 388,000 \$ 124,000 \$ 1,075,000 \$ \$ \_ -\$ \$ 2090 \$ 241,000 \$ \$ 162,000 \$ 1,443,000 2,150,000 --\$ \$ 2091 45.000 412.000 \$ 124.000 \$ 1,141,000 \$ \$ \_ -\$ 2092 \$ 45,000 \$ 424,000 \$ 124,000 \$ 1,175,000 \$ \_ \_ 2093 \$ 45,000 437,000 124,000 1,210,000 \$ \$ \$ \$ \$ --\$ 189,000 \$ 2094 \$ \$ \$ 45,000 \$ 450,000 1,898,000 \$ 2095 \$ 322,000 \$ 3,325,000 \$ 401,000 \$ 4,145,000 \$ --\$ \$ 2096 607.000 6,455,000 \$ 686.000 \$ 7,302,000 \$ \$ -\$ \$ 2097 186,000 \$ 2,043,000 \$ 266,000 \$ 2,915,000 \$ \_ \_ 2098 \$ 186,000 \$ 2,104,000 \$ 396,000 \$ 4,469,000 \$ \$ --2,923,000 \$ \$ 2099 251,000 \$ \$ 396,000 \$ 4,603,000 \$ \_ \_ \$ \$ \$ \$ \$ 2100 368,000 \$ 4,412,000 513,000 6,143,000 --

### Table F-9 VOCs in Waste Remedy Costs Including Inflation 3% Annual Inflation

\$

251,000

\$

3,102,000

\$

2101

396.000

\$

4,884,000

\$

-

\$

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| 3% Annual Inflation  |      |            |    |                 |    |            |                 |             |    |                   |    |            |
|----------------------|------|------------|----|-----------------|----|------------|-----------------|-------------|----|-------------------|----|------------|
| Voar                 | Refe | ference    |    | Less Aggressive |    |            | More Aggressive |             |    |                   |    |            |
| i eai                |      | \$US 2016  |    | 3% Inf.         |    | \$US 2016  |                 | 3% Inf.     |    | \$US 2016 3% Inf. |    | 3% Inf.    |
| 2102                 | \$   | 251,000    | \$ | 3,195,000       | \$ | 396,000    | \$              | 5,031,000   | \$ | -                 | \$ | -          |
| 2103                 | \$   | 252,000    | \$ | 3,292,000       | \$ | 396,000    | \$              | 5,182,000   | \$ | -                 | \$ | -          |
| 2104                 | \$   | 252,000    | \$ | 3,391,000       | \$ | 396,000    | \$              | 5,338,000   | \$ | -                 | \$ | -          |
| 2105                 | \$   | 464,000    | \$ | 6,437,000       | \$ | 608,000    | \$              | 8,442,000   | \$ | -                 | \$ | -          |
| 2106                 | \$   | 252,000    | \$ | 3,598,000       | \$ | 396,000    | \$              | 5,663,000   | \$ | -                 | \$ | -          |
| 2107                 | \$   | 252,000    | \$ | 3,706,000       | \$ | 396,000    | \$              | 5,834,000   | \$ | -                 | \$ | -          |
| 2108                 | \$   | 252,000    | \$ | 3,818,000       | \$ | 396,000    | \$              | 6,009,000   | \$ | -                 | \$ | -          |
| 2109                 | \$   | 187,000    | \$ | 2,918,000       | \$ | 331,000    | \$              | 5,175,000   | \$ | -                 | \$ | -          |
| 2110                 | \$   | 304,000    | \$ | 4,888,000       | \$ | 448,000    | \$              | 7,213,000   | \$ | -                 | \$ | -          |
| 2111                 | \$   | 187,000    | \$ | 3,096,000       | \$ | 331,000    | \$              | 5,490,000   | \$ | -                 | \$ | -          |
| 2112                 | \$   | 187,000    | \$ | 3,189,000       | \$ | 331,000    | \$              | 5,655,000   | \$ | -                 | \$ | -          |
| 2113                 | \$   | 187,000    | \$ | 3,285,000       | \$ | 331,000    | \$              | 5,825,000   | \$ | -                 | \$ | -          |
| 2114                 | \$   | 187,000    | \$ | 3,383,000       | \$ | 331,000    | \$              | 6,000,000   | \$ | -                 | \$ | -          |
| 2115                 | \$   | 793,000    | \$ | 14,801,000      | \$ | 938,000    | \$              | 17,497,000  | \$ | -                 | \$ | -          |
| Total <sup>(1)</sup> | \$   | 21,700,000 | \$ | 126,500,000     | \$ | 24,200,000 | \$              | 178,600,000 | \$ | 19,100,000        | \$ | 27,400,000 |

## Table F-9VOCs in WasteRemedy Costs Including Inflation3% Annual Inflation

Note:

- 2016 US Dollars (\$US 2016)

(1) Rounded to the nearest \$10,000

% - percent

Inf. - inflation

### Table F-10 VOCs in Waste Reference Remedy Lifecycle Cost Assumptions

| Task  | Assumptions   |   |  |  |  |  |  |
|---|---|---|--|--|--|--|--|
| Task  | Frequency   | Description   |  |  |  |  |  |
| SAP/QAPP Update                                   | Every 5 years, starting Year 1 (2016)   | Update to SAP and QAPP detailing locations/wells to be sampled for a five year period, updated to SOPs and or laboratory requirements   |  |  |  |  |  |
| Water Level Monitoring                            | Two events per year beginning Year 1<br>(2016) through Year 100 (2115), 25%<br>reduction at Year in 30 (2045) and<br>additional 25% reduction in year 50<br>(2065)  | Water level monitoring to be conducted semi-annually prior to passive sampling - 70 well elevations collected in 5 days per event   |  |  |  |  |  |
| Groundwater Sampling                              | Annual Event (Odd Years): Includes<br>Semi [16 wells] & Annual [23 wells]<br>Events and Biannual Event (Even<br>Years): Includes Semi & Annual<br>Events + Biannual Event [28 wells]<br>beginning in Year 1 though Year 29.<br>25% reduction of LOE at Year 30<br>(2045) and additional 25% reduction<br>of LOE at Year 50 (2065) (based on<br>sampling reduction as plume begins<br>to dilute) | Groundwater Sampling to be conducted semi-annually (16 wells),<br>annually (23 wells) and biannually (28 wells) with PDBs.<br>Semi-annual frequency wells will be focused around potentially<br>affected COT wells and source areas.<br>Annual frequency wells are inside and around edges of 5 ppb plume.<br>Biannual frequency wells are outside of plume or century wells.<br>Sampling locations (frequency) will be reevaluated as plume moved<br>down gradient addressed in SAP/QAPP Updates every five years.<br>i.e.<br>Sample ~69 samples per year (Year 1 to Year 29)<br>Sample ~48 samples per year (Year 30 to Year 49)<br>Sample ~32 samples per year (Year 50 to Year 100) - possible<br>reduction of amount of wells but increased frequency at each well for<br>well head protection |  |  |  |  |  |
| Reporting   | Annually, Starting Year 1 (2016)<br>25% reduction of LOE at Year 30<br>(2045) and additional 25% reduction<br>of LOE at Year 50 (2065) (based on<br>sampling reduction)   | One annual report prepared per year, includes results from semi-<br>annual & annual sampling (and biannual, if applicable) - includes cost<br>for preparation, GIS, data validation and data management   |  |  |  |  |  |
| Groundwater Monitoring Well<br>Replacement        | One monitoring well installed every 10<br>years, Starting Year 10 (2025)  | Installation of groundwater monitoring wells (replacement of damaged<br>or abandoned well)- Subcontracted drilling (5" dia., ~350 ft),<br>permitting, & waste disposal, 6 days each well  |  |  |  |  |  |
| Groundwater Monitoring Well<br>Abandonment        | Two monitoring wells abandoned<br>every 5 years, starting Year 5 (2020)   | Abandonment of groundwater monitoring wells - Subcontracted over drilling/grouting (~300 ft), permitting, & waste disposal, 3 days each well  |  |  |  |  |  |
| Final Groundwater Monitoring Well<br>Abandonments | Once, Following Year 100 (2115)   | Final removal of all wells associated with monitoring well network (10 remain at Year 100)  |  |  |  |  |  |

## Table F-11VOCs in WasteLess Aggressive RemedyLifecycle Cost Assumptions

| Task  | Assumptions   |   |  |  |  |  |
|---|---|---|--|--|--|--|
| 1036  | Frequency   | Description   |  |  |  |  |
| SAP/QAPP Update                                   | Every 5 years, starting Year 1 (2016)   | Update to SAP and QAPP detailing locations/wells to be sampled for a five year period, updated to SOPs and or laboratory requirements   |  |  |  |  |
| Water Level Monitoring                            | Two events per year beginning Year<br>1 (2016) through Year 100 (2115),<br>25% reduction at Year in 30 (2045)<br>and additional 25% reduction in year<br>50 (2065)  | Water level monitoring to be conducted semi-annually prior to passive sampling - 70 well elevations collected in 5 days per event   |  |  |  |  |
| Groundwater Sampling                              | Annual Event (Odd Years): Includes<br>Semi [16 wells] & Annual [23 wells]<br>Events and Biannual Event (Even<br>Years): Includes Semi & Annual<br>Events + Biannual Event [28 wells]<br>beginning in Year 1 though Year 29.<br>25% reduction of LOE at Year 30<br>(2045) and additional 25% reduction<br>of LOE at Year 50 (2065) (based on<br>sampling reduction as plume begins<br>to dilute) | Groundwater Sampling to be conducted semi-annually (16 wells),<br>annually (23 wells) and biannually (28 wells) with PDBs.<br>Semi-annual frequency wells will be focused around potentially<br>affected COT wells and source areas.<br>Annual frequency wells are inside and around edges of 5 ppb plume.<br>Biannual frequency wells are outside of plume or century wells.<br>Sampling locations (frequency) will be reevaluated as plume moved<br>down gradient addressed in SAP/QAPP Updates every five years.<br>i.e.<br>Sample ~69 samples per year (Year 1 to Year 29)<br>Sample ~48 samples per year (Year 30 to Year 49)<br>Sample ~32 samples per year (Year 50 to Year 100) - possible<br>reduction of amount of wells but increased frequency at each well for<br>well head protection |  |  |  |  |
| Reporting   | Annually, Starting Year 1 (2016)<br>25% reduction of LOE at Year 30<br>(2045) and additional 25% reduction<br>of LOE at Year 50 (2065) (based on<br>sampling reduction)   | One annual report prepared per year, includes results from semi-<br>annual & annual sampling (and biannual, if applicable) - includes<br>cost for preparation, GIS, data validation and data management   |  |  |  |  |
| Groundwater Monitoring Well<br>Replacement        | One monitoring well installed every 10 years, Starting Year 10 (2025)   | Installation of groundwater monitoring wells (replacement of damaged or abandoned well)- Subcontracted drilling (5" dia., ~350 ft), permitting, & waste disposal, 6 days each well  |  |  |  |  |
| Groundwater Monitoring Well<br>Abandonment        | Two monitoring wells abandoned<br>every 5 years, starting Year 5 (2020)   | Abandonment of groundwater monitoring wells - Subcontracted over drilling/grouting (~300 ft), permitting, & waste disposal, 3 days each well  |  |  |  |  |
| Final Groundwater Monitoring Well<br>Abandonments | Once, Following Year 100 (2115)   | Final removal of all wells associated with monitoring well network (10 remain at Year 100)  |  |  |  |  |

## Table F-12VOCs in WasteMore Aggressive RemedyLifecycle Cost Assumptions

| Task  | Assumptions   |   |  |  |  |  |
|---|---|---|--|--|--|--|
|   | Frequency   | Description   |  |  |  |  |
| SAP/QAPP Update                                   | Every 5 years, starting Year 1 (2016)   | Update to SAP and QAPP detailing locations/wells to be sampled for a five year period, updated to SOPs and or laboratory requirements   |  |  |  |  |
| Water Level Monitoring                            | Two events per year beginning Year 1<br>(2016) through Year 29 (2044) -<br>Termination in Year 29   | Water level monitoring to be conducted semi-annually prior to passive sampling - 70 well elevations collected in 5 days per event   |  |  |  |  |
| Groundwater Sampling                              | Annual Event (Odd Years): Includes<br>Semi [16 wells] & Annual [23 wells]<br>Events and Biannual Event (Even<br>Years): Includes Semi & Annual<br>Events + Biannual Event [28 wells]<br>beginning in Year 1 though Year 29<br>Termination Year 29 | Groundwater Sampling to be conducted semi-annually (16 wells),<br>annually (23 wells) and biannually (28 wells) with PDBs.<br>Semi-annual frequency wells will be focused around potentially<br>affected COT wells and source areas.<br>Annual frequency wells are inside and around edges of 5 ppb plume.<br>Biannual frequency wells are outside of plume or century wells.<br>Sampling locations (frequency) will be reevaluated as plume moved<br>down gradient addressed in SAP/QAPP Updates every five years. |  |  |  |  |
| Operational Sampling Analytical Cost              | Monthly & Weekly Samples -<br>Termination Year 29   | 5 Monthly Operational Samples & 1 Weekly Sample + QAQC from<br>Containment System - VOC Analytical Cost Only  |  |  |  |  |
| Reporting   | Annually, Starting Year 1 (2016)  | One annual report prepared per year, includes results from semi-<br>annual & annual sampling (and biannual, if applicable) - includes cost<br>for preparation, GIS, data validation and data management   |  |  |  |  |
| Groundwater Monitoring Well<br>Replacement        | One monitoring well installed every 10 years, Starting Year 10 (2025)   | Installation of groundwater monitoring wells (replacement of damaged or abandoned well)- Subcontracted drilling (5" dia., ~350 ft), permitting, & waste disposal, 6 days each well  |  |  |  |  |
| Groundwater Monitoring Well<br>Abandonment        | Two monitoring wells abandoned<br>every 5 years, starting Year 5 (2020)   | Abandonment of groundwater monitoring wells - Subcontracted over drilling/grouting (~300 ft), permitting, & waste disposal, 3 days each well  |  |  |  |  |
| Final Groundwater Monitoring Well<br>Abandonments | Once, Following Year 29 (2045)  | Final removal of all wells associated with monitoring well network (30 remain at Year 2045)   |  |  |  |  |

## Table F-13VOCs in WasteReference Remedy Groundwater TreatmentO&M Costs

| Task                  |                    | Assumptions   |  |  |  |  |  |
|-----------------------|--------------------|---|--|--|--|--|--|
| Task                  | Frequency          | Description   |  |  |  |  |  |
| Routine Inspections   | Weekly             | Eight (8) hrs of operator time and truck to conduct routine operations and maintenance activities at each well site (411-P and C-051B).   |  |  |  |  |  |
| Alarm Callouts        | Once per month     | Eight (8) hrs of operator time and truck to respond to non-routine alarm callouts at each well site (411-P and C-051B).   |  |  |  |  |  |
| Vessel Maintenance    | Once every 5 years | Spot repair vessel lining caused by corrosion. Assumed \$5,000 for 411-P and \$15,000 for C-051B.   |  |  |  |  |  |
| Quarterly Maintenance | Quarterly          | Perform quarterly maintenance activities and repair equipment as needed. Sixteen hours (16) of operator time and annual costs of \$1,000 in materials for 411-P and \$3,000 for C-051B. |  |  |  |  |  |
| Materials             | As Needed          | Assumed various general materials will be purchased (e.g. paint, hardware) in the amount of \$1,000 per well site (411-P and C-051B).   |  |  |  |  |  |
| Carbon Replacement    | As Needed          | Carbon usage based on mass loading data obtained from the 2015<br>Groundwater Modeling Report. Assumed \$1.50/lb of GAC usage.  |  |  |  |  |  |
| Pump Replacements     | Once every 5 years | Assumed pumps would need to be replaced every 5 years (Booster pump in C-051B [\$15,000] and booster pump in 411-P[\$3,000]).   |  |  |  |  |  |
| Sediment Pre-Filters  | As Needed          | Assumed bag pre-filters will need to be replaced periodically and allocated \$1,000 annually.   |  |  |  |  |  |
| Autodialer            | Monthly            | Cost for autodialer at each well site (\$50/month).   |  |  |  |  |  |
| Electricity Cost      | Continuous         | Electricity Cost based on a booster pump size at each well site (C-<br>051B [10HP] and 411-P [2HP)) and ancillary equipment.  |  |  |  |  |  |
| Tucson Supplied Water | Continuous         | Water replacement cost (\$2.64/ccf) for well sites CVA, Mayo, and SWAIN   |  |  |  |  |  |

## Table F-14VOCs in WasteLess Aggressive Remedy Groundwater TreatmentO&M Costs

| Took                  | Assumptions        |  |  |  |  |  |
|-----------------------|--------------------|--|--|--|--|--|
| IdSK                  | Frequency          | Description  |  |  |  |  |
| Routine Inspections   | Weekly             | Eight (8) hrs of operator time and truck to conduct routine operations and maintenance activities at each well site (411-P, C-051B, and C-058B).   |  |  |  |  |
| Alarm Callouts        | Once per month     | Eight (8) hrs of operator time and truck to respond to non-routine alarm callouts at each well site (411-P and C-051B).  |  |  |  |  |
| Vessel Maintenance    | Once every 5 years | Spot repair vessel lining caused by corrosion. Assumed \$5,000 for 411-P, \$15,000 for C-051B, \$15,000 for C-058B.  |  |  |  |  |
| Quarterly Maintenance | Quarterly          | Perform quarterly maintenance activities and repair equipment as needed. Sixteen hours (16) of operator time and annual costs of \$1,000 in materials for 411-P, \$3,000 for C-051B, and \$3,000 for C-058B. |  |  |  |  |
| Materials             | As Needed          | Assumed various general materials will be purchased (e.g. paint, hardware) in the amount of \$1,000 per well site (411-P, C-051B, and C-058B).   |  |  |  |  |
| Carbon Replacement    | As Needed          | Carbon usage based on mass loading data obtained from the 2015<br>Groundwater Modeling Report. Assumed \$1.50/lb of GAC.   |  |  |  |  |
| Pump Replacements     | Once every 5 years | Assumed pumps would need to be replaced every 5 years (Booster pump in C-051B [\$15,000], C-058B [\$15,000] and booster pump in 411-P[\$3,000]).   |  |  |  |  |
| Sediment Pre-Filters  | As Needed          | Assumed bag pre-filters will need to be replaced periodically and allocated \$1,000 annually.  |  |  |  |  |
| Autodialer            | Monthly            | Cost for autodialer at each well site (\$50/month).  |  |  |  |  |
| Electricity Cost      | Continuous         | Electricity Cost based on a booster pump size at each well site (C-051B [10HP], C-058B [10HP] and 411-P [2HP)) and ancillary equipment.  |  |  |  |  |
| Tucson Supplied Water | Continuous         | Water replacement cost (\$2.64/ccf) for well sites CVA, Mayo, and SWAIN  |  |  |  |  |

## Table F-15VOCs in WasteMore Aggressive Remedy Groundwater TreatmentO&M Costs

| Task                  | Assumptions        |  |  |  |  |  |
|-----------------------|--------------------|--|--|--|--|--|
| IdSK                  | Frequency          | Description  |  |  |  |  |
| Routine Inspections   | Weekly             | Eight (8) hrs of operator time and truck to conduct routine operations and maintenance activities at WCS and well site 411-P.  |  |  |  |  |
| Alarm Callouts        | Once per month     | Eight (8) hrs of operator time and truck to respond to non-routine alarm callouts at WCS and well site 411-P.  |  |  |  |  |
| Vessel Maintenance    | Once every 5 years | Spot repair vessel lining caused by corrosion. Assumed \$15,000 for WCS vessels and \$5,000 for 411-P.   |  |  |  |  |
| Quarterly Maintenance | Quarterly          | Perform quarterly maintenance activities and repair equipment as needed. Sixteen hours (16) of operator time and annual costs of \$3,000 in materials for WCS and \$1,000  |  |  |  |  |
| Materials             | As Needed          | Assumed various general materials will be purchased (e.g. paint, hardware) in the amount of \$1,000 for WCS and well site (411-P), and \$500 for each well location (EX-02, C-022A, R-092A)                          |  |  |  |  |
| Carbon Replacement    | As Needed          | Carbon usage based on mass loading data obtained from the 2015<br>Groundwater Modeling Report. Assumed \$1.50/lb of GAC.   |  |  |  |  |
| Well Cleaning         | Once every 5 years | Assume well sites (EX-02 [\$20,000], C-022A [\$20,000], R-092 [20,000], and Injection Well [\$25,000]) will require routine cleaning.  |  |  |  |  |
| Pump Replacements     | Once every 5 years | Assumed pumps would need to be replaced every 5 years. Booster pump in 411-P[\$3,000], Tank Return Pump at WCS (\$15,000) and well pumps in EX-02, C-022A, and R-092A each at a cost of \$15,000.                    |  |  |  |  |
| Sediment Pre-Filters  | As Needed          | Assumed bag pre-filters will need to be replaced periodically and allocated \$1,000 annually for WCS and 411-P.  |  |  |  |  |
| Autodialer            | Monthly            | Cost for autodialer at each WCS and 411-P (\$50/month).  |  |  |  |  |
| Electricity Cost      | Continuous         | Electricity Cost based on a booster pump at well site 411-P [2HP),<br>Tank Return Pump at WCS, and extraction wells (EX-02 [20HP], C-<br>022A [40HP], and R-092A [75HP] and ancillary equipment at each<br>location. |  |  |  |  |

### Table F-16 VOCs in Waste Soil Vapor Extraction (SVE) Lifecycle Costs

| Lesstian                      |                                  | Task                                      | Assun   | nptions  |
|-------------------------------|----------------------------------|---|---|--|
| Location                      |                                  | Task                                      | Frequency   | Description  |
|                               |                                  | SAP/QAPP Update                           | Once every 5 years - Starting Year 3 (2018)<br>until Year 18 (2033)                                 | Update to SAP and QAPP detailing<br>locations/wells to be sampled for each<br>monitoring event (once per five years),<br>updated to SOPs and or laboratory<br>requirements   |
| Broadway<br>North<br>Landfill | Deep Soil<br>Vapor<br>Monitoring | Deep Soil Vapor Sampling                  | One event every 5 years for 20 years - 50%<br>reduction in sampling locations in Year 13<br>(2028). | Soil vapor samples to be collected from<br>existing soil vapor locations deeper than 150<br>ft bgs in/near footprint of GW plume within<br>the BNL -<br>30 soil vapor samples collected during Year<br>3 (2018) & Year 8 (2023)<br>15 soil vapor samples collected during Year<br>13 (2028) & Year 18 (2033) |
|                               |                                  | Reporting                                 | Once every 5 years - Starting Year 3 (2018)<br>until Year 18 (2033)                                 | One report prepared per event (once per 5<br>years), includes - includes cost for<br>preparation, GIS, data validation and data<br>management  |
|                               |                                  | Soil Vapor Monitoring Well<br>Replacement | Once - Year 2 (2017)  | Replacement of damaged DP-6:<br>Abandonment of DP-6 and subcontracted<br>drilling (1" nested probes, ~250 ft),<br>permitting, & waste disposal   |
|                               |                                  | Final Vapor Well<br>Abandonments          | Once - Following Year 20 (2033+)  | Final removal of all wells associated with monitoring well network (18)  |

### Table F-16 VOCs in Waste Soil Vapor Extraction (SVE) Lifecycle Costs

| Location                      | Task                                |  | Assumptions  |   |  |
|-------------------------------|-------------------------------------|--|--|---|--|
| Location                      |                                     |  | Frequency  | Description   |  |
| Broadway<br>South<br>Landfill | Deep Soil<br>Vapor<br>Monitoring    | SAP/QAPP Update                            | Once every 5 years - Year 1 (2016) through<br>Year 20 (2035)   | Update to SAP and QAPP detailing<br>locations/wells to be sampled for each<br>monitoring event (once per five years),<br>updated to SOPs and or laboratory<br>requirements  |  |
|                               |                                     | Deep Soil Vapor Sampling                   | Annually -Year 1 (2016) through Year 5<br>(2020) then every 5 years until Year 20<br>(2035) - Year 10 (2025), Year 15 (2030) &<br>Year 20 (2035) | Soil vapor samples to be collected from<br>existing soil vapor locations - in/near<br>footprint of the GW plume at BSL<br>44 soil vapor samples (11 locations 9<br>existing and 2 new multiport wells) collected<br>annually during Year 1 (2016) through Year<br>5 (2020)<br>22 soil vapor samples collected every 5<br>years during Year 10 (2025), Year 15 (2030)<br>& Year 20 (2035) - reduction 50% based on<br>GW plume foot print reduction at BSL |  |
|                               |                                     | Reporting                                  | Annually -Year 1 (2016) through Year 5<br>(2020) then every 5 years until Year 20<br>(2035) - Year 10 (2025), Year 15 (2030) &<br>Year 20 (2035) | One report prepared per event includes -<br>includes cost for preparation, GIS, data<br>validation and data management  |  |
|                               |                                     | Soil Vapor Monitoring Well<br>Installation | Once - Year 1 (2016)   | Installation of two new nested monitoring<br>vapor monitoring wells within BSL. Includes<br>subcontracted drilling (six 1" nested probes,<br>~350 ft), permitting, & waste disposal   |  |
|                               |                                     | Final Vapor Well<br>Abandonments           | Once - Following Year 20 (2035+)   | Final removal of all wells associated with soil vapor monitoring network (9)  |  |
|                               | Shallow Soil<br>Vapor<br>Monitoring | Final Vapor Well<br>Abandonments           | Once, Following Year 6 (2021+)   | Final removal of all wells associated with monitoring well network (13)   |  |

## Table F-17VOCs in WasteIn-Situ Chemical Oxidation (ISCO)Lifecycle Costs

| Task                   | Assumptions |   |  |
|------------------------|-------------|---|--|
| lask                   | Frequency   | Description   |  |
|                        | Quarterly   | Assume 10 wells will be sampled with 50% vertical profiling for the first |  |
| weii Sampling          |             | 3 years of operations over a one week period.                             |  |
| Final Well Abandonment | Once        | Wells will be abandoned at the end of the program.                        |  |
|                        |             | Equipment used for sampling activities include a colorimeter,             |  |
| Equipment              | Quarterly   | groundwater parameter meter, ORP meter, water level sounder, flow         |  |
|                        |             | through cell, and passive diffusion bags.                                 |  |

### Table F-18 VOCs in Waste Soil Vapor Extraction (SVE) O&M Assumptions

| Task                               | Assumptions  |  |  |
|------------------------------------|--|--|--|
| IdSK                               | Frequency  | Description  |  |
| Routine Inspections                | 2 times per week   | Eight (8) hrs of operator time and truck to conduct routine operations and maintenance activities. |  |
| Carbon Vessels Rental/Carbon Usage | One changeout per month Assume each changeout is 1,000 lbs of vapor phase carbon |  |  |
| Process Sampling                   | 2 samples per month  | Sampling carbon vessel inlet and outlet.   |  |
| Condensate Disposal                | 2 time per year  | Total condensate disposal fee estimated at \$10,000.   |  |
| General Maintenance                | As Needed  | Annual costs of general materials estimated at \$6,000.  |  |
| Autodialer                         | Monthly  | Cost for autodialer at each well site (\$50/month).  |  |
| Electricity Cost                   | Continuous   | Electricity usage based on a 30 HP rental blower.  |  |

### Table F-19 VOCs in Waste In-Situ Chemical Oxidation (ISCO) O&M Costs

| Task                | Assumptions      |  |  |
|---------------------|------------------|--|--|
| IdSK                | Frequency        | Description  |  |
| Routine Inspections | 2 times per week | Eight (8) hrs of operator time and truck to conduct routine operations and maintenance activities. |  |
| Sodium Permanganate | Continuous       | 7,700 gallons of 40% solution used during treatment.   |  |
| Well Maintenance    | As Needed        | Allocation of \$15,000 for as needed well maintenance annually.                                    |  |
| General Maintenance | As Needed        | Annual costs of general materials estimated at \$6,000.  |  |
| Autodialer          | Monthly          | Cost for autodialer at each well site (\$50/month).  |  |
| Electricity Cost    | Continuous       | Electricity usage based on 3-10 HP and 1-5HP pump motors.  |  |