**Carroll County**
Alternatives Evaluation

# Appendix C

## Groundwater Assessment

6531-001-400

MALCOLM PIRNIE

| Alt | Growth Area | DEMAND ❶ Probable Maximum Additional Water Requirement [gpd] | SERVICE AREA MDE AVAILABLE RECHARGE (Priority + Future Service Area) ❶ Area [ac] | ❷ Total Available Recharge [gpd] | ❸ Remaining Available Recharge [gpd] | ❹ Projected Water Surplus [gpd] | ❺ Total Required MDE GW Recharge Area [ac] | ESTIMATED WELL REQUIREMENTS ❶ Number of Additional Wells based on Average MDE Appropriation per Groundwater Well [-] | ❷ Total Exploration Sites [-] |
|---|---|---|---|---|---|---|---|---|---|
| ***G-1*** | ***Hampstead*** | ***528,000*** | ***2,656*** | ***934,979*** | ***214,364*** | ***-313,636*** | ***891*** | ***20*** | ***28*** |
| *G-2* | *Mount Airy* | *364,000* | *3,543* | *1,197,463* | *532,598* | *168,598* | *0* | *5* | *54* |
| ***G-3*** | ***New Windsor*** | ***198,000*** | ***953*** | ***290,665*** | ***94,665*** | ***-103,335*** | ***339*** | ***3*** | ***22*** |
| ***G-4*** | ***Taneytown*** | ***1,164,000*** | ***3,274*** | ***949,460*** | ***366,460*** | ***-797,540*** | ***2,750*** | ***16*** | ***5*** |
| ***G-5*** | ***Union Bridge*** | ***594,000*** | ***1,430*** | ***436,150*** | ***227,850*** | ***-366,150*** | ***1,200*** | ***6*** | ***11*** |
| *G-6* | *Westminster* | *1,176,000†* | *8,543* | *3,007,136* | *1,531,136* | *355,136* | *0* | *9* | *38* |
| *G-7* | *Union Mills* | *N/A* | *1,600* | *563,310* | *563,310* | *563,310* | *0* | *10* | *--* |
| *G-8* | *Manchester* | *124,000††* | *0* | *0* | *0* | *0* | *0* | *6* | *--* |
| | **WSA Totals** | **4,148,000** | **20,399** | **6,815,853** | **2,967,073** | **-1,056,927** | **5,180** | **75** | **158** |

**Notes:**

❶ Projected maximum groundwater requirement (see Table 2-1)

❶ Area of Priority+Future Service Area (GIS layer supplied by County)

❷ Total Available Recharge in Priority+Future Service Areas based on recommended MDE method (Recharge = 1yrQ10 - 7Q10 by hydrogeomorphic region)

❸ Adjusted Available Recharge in Piority+Future Service Areas (Total Available adjusted by subtracting existing allocations)

❹ Projected Surplus of Available Recharge (Max(❸,0)-❶)

❺ The amount of additional land that a given WSA would need to own/control to obtain an appropriation permit to meet total projected demands by groundwater ( -MIN(❶/,0)*❷/❶)

❶ Estimated number of wells needed to meet maximum probable GW demands ❶

❷ Total number potential wells sites identified by the County and its water service areas for exploration

† Assumed existing withdrawals in Westminster are equal to actual yield because existing wells are known to have significantly lower yields than the permitted amount

†† Manchester needs additional wells to access water that is already appropriated, but cannot be used due to reduced well capacities.

## Hampstead Groundwater Budget

**Prepared by:** Carroll County Staff **Date:** 5/21/2009

| | Appropriation Watershed | | | WSA Totals |
|---|---|---|---|---|
| **Own & Control Type** | **Patapsco** | **Gunpowder** | **Loch Raven** | |
| **Size (ac)** | | | | |
| WSA Priority+Future | 1,060 | 1,189 | 407 | **2,656** |
| GAB | 1,815 | 1,193 | 413 | **3,421** |
| | | | | |
| **Recharge Rate (gpd/ac)** | **352** | **352** | **352** | |
| | | | | |
| **Own/Control Water (gpd)** | | | | |
| WSA Priority+Future | 373,215 | 418,609 | 143,155 | **934,979** |
| GAB | 638,880 | 419,936 | 145,376 | **1,204,192** |
| | | | | |
| **Existing Appropriations (gpd)** | **583,000** | **206,400** | **141,000** | **930,400** |
| | | | | |
| **Net Availability (gpd)** | | | | |
| WSA Priority+Future | -209,785 | 212,209 | 2,155 | **214,364** |
| GAB | 55,880 | 213,536 | 4,376 | **273,792** |

| **Existing Appropriations** | **930,400** | **Comment** |
|---|---|---|
| | | |
| **Patapsco** | **583,000** | |
| *County Wells* | *283,000* | |
| *11* | | *N Main Street* |
| *12* | | *N Main Street* |
| *20* | | *Hospital Well* |
| *21* | | *Hospital Well* |
| *28* | | *Corbin Well Field* |
| *29* | | *Corbin Well Field* |
| *31* | | *Widerman Well Field* |
| *32* | | *Widerman Well Field* |
| *Black & Decker* | *300,000* | *Remediation Well* |
| | | |
| **Gunpowder** | **206,400** | |
| *County Wells* | *156,000* | |
| *19* | | *Greenmount Church* |
| *24* | | *Small Crossings* |
| *25* | | *Small Crossings* |
| *TWC* | | |
| *PWC-1* | | |
| *33* | | *North Carroll Farm* |
| *34* | | *North Carroll Farm* |
| *Oakmont Green Golf Course* | *50,400* | |
| | | |
| **Loch Raven** | **141,000** | |
| *13* | | *Route 88* |
| *15* | | *Route 88* |
| *22* | | *Roberts Field* |
| *23* | | *Roberts Field* |
| *26* | | *Roberts Field* |
| *27* | | *Roberts Field* |

## Mount Airy Groundwater Budget

**Prepared by:** Carroll County Staff **Date:** 5/27/2009

| | Appropriation Watershed | | | | WSA Totals |
|---|---|---|---|---|---|
| Own & Control Type | Middle Run | South Branch Patapsco | Woodville Branch | Upper Bush Creek | |
| **Size (ac)** | | | | | |
| WSA Priority+Future | 220 | 1,524 | 1,393 | 406 | **3,543** |
| GAB | 253 | 1,737 | 1,393 | 398 | **3,781** |
| | | | | | |
| **Recharge Rate (gpd/ac)** | **372** | **372** | **305** | **305** | |
| | | | | | |
| **Own/Control Water (gpd)** | | | | | |
| WSA Priority+Future | 81,840 | 566,928 | 424,865 | 123,830 | **1,197,463** |
| GAB | 94,116 | 646,055 | 424,865 | 121,390 | **1,286,426** |
| | | | | | |
| **Existing Appropriations (gpd)** | **38,000** | **90,000** | **625,000** | **112,000** | **865,000** |
| | | | | | |
| **Net Availability (gpd)** | | | | | |
| WSA Priority+Future | 43,840 | 476,928 | -200,135 | 11,830 | **532,598** |
| GAB | 56,116 | 556,055 | -200,135 | 9,390 | **621,561** |

| | |
|---|---|
| **Existing Appropriations** | **865,000** |
| **Middle Run (NE Basin)** | **38,000** |
| *Well 5* | *38,000* |
| **South Branch (SE Basin)** | **90,000** |
| *Well 6* | *90,000* |
| **Woodville Branch (NW basin)** | **625,000** |
| *Wells 1, 2, 3, 4* | *307,000* |
| *Well 8* | *162,000* |
| *Well 9* | *79,000* |
| *Well 10* | *77,000* |
| **Upper Brush Creek (SW Basin)** | **112,000** |
| *Well 7* | *112,000* |

## New Windsor Groundwater Budget

**Prepared by:** Carroll County Staff **Date:** 5/27/2009

| | Appropriation Watershed | | | WSA Totals |
|---|---|---|---|---|
| **Own & Control Type** | **Dickerson Run** | **Little Pipe Creek** | **Turkeyfoot Run** | |
| **Size (ac)** | | | | |
| WSA Priority+Future | 654 | 98 | 201 | **953** |
| GAB | 658 | 101 | 201 | **960** |
| | | | | |
| **Recharge Rate (gpd/ac)** | **305** | **305** | **305** | |
| | | | | |
| **Own/Control Water (gpd)** | | | | |
| WSA Priority+Future | 199,470 | 29,890 | 61,305 | **290,665** |
| GAB | 200,690 | 30,805 | 61,305 | **292,800** |
| | | | | |
| **Existing Appropriations (gpd)** | **196,000** | **0** | **0** | **196,000** |
| | | | | |
| **Net Availability (gpd)** | | | | |
| WSA Priority+Future | 3,470 | 29,890 | 61,305 | **94,665** |
| GAB | 4,690 | 30,805 | 61,305 | **96,800** |

| | | |
|---|---|---|
| **Existing Appropriations** | **196,000.00** | |
| | | |
| **Dickerson Run** | **196,000.00** | |
| *Main spring/Dennings* | *143,000.00* | |
| *Roops Meadow/Hillside* | *53,000.00* | |
| *Dickerson Run* | *0.00* | *emergency use only* |
| | | |
| **Little Pipe Creek** | **0.00** | |
| | | |
| **Turkeyfoot Run** | **0.00** | |

## Taneytown Groundwater Budget

**Prepared by:** Carroll County Staff **Date:** 5/27/2009

| | Appropriation Watershed | | WSA Totals |
|---|---|---|---|
| **Own & Control Type** | **Big Pipe Creek** | **Piney Creek** | |
| **Size (ac)** | | | |
| WSA Priority+Future | 540 | 2,734 | **3,274** |
| GAB | 539 | 2,730 | **3,269** |
| | | | |
| **Recharge Rate (gpd/ac)** | **290** | **290** | |
| | | | |
| **Own/Control Water (gpd)** | | | |
| WSA Priority+Future | 156,600 | 792,860 | **949,460** |
| GAB | 156,310 | 791,700 | **948,010** |
| | | | |
| **Existing Appropriations (gpd)** | **103,000** | **480,000** | **583,000** |
| | | | |
| **Net Availability (gpd)** | | | |
| WSA Priority+Future | 53,600 | 312,860 | **366,460** |
| GAB | 53,310 | 311,700 | **365,010** |

| | |
|---|---|
| **Existing Appropriations** | **583,000** |

| | |
|---|---|
| **Piney Creek** | **103,000** |
| *wells 15 & 16* | *103,000* |
| **Big Pipe Creek** | **480,000** |
| *wells 8,9,11,12,13* | *390,000* |
| *well 14* | *90,000* |

## Union Bridge Groundwater Budget

**Prepared by:** Carroll County Staff **Date:** 5/28/2009

| | Appropriation Watershed | | | WSA Totals |
|---|---|---|---|---|
| **Own & Control Type** | **Sams Creek** | **Priestland Branch** | **Cherry Branch / Little Pipe** | |
| **Size (ac)** | | | | |
| WSA Priority+Future | 393 | 767 | 270 | **1,430** |
| GAB | 427 | 921 | 292 | **1,640** |
| | | | | |
| **Recharge Rate (gpd/ac)** | **305** | **305** | **305** | |
| | | | | |
| **Own/Control Water (gpd)** | | | | |
| WSA Priority+Future | 119,865 | 233,935 | 82,350 | **436,150** |
| GAB | 130,235 | 280,905 | 89,060 | **500,200** |
| | | | | |
| **Existing Appropriations (gpd)** | **0** | **208,300** | **0** | **208,300** |
| | | | | |
| **Net Availability (gpd)** | | | | |
| WSA Priority+Future | 119,865 | 25,635 | 82,350 | **227,850** |
| GAB | 130,235 | 72,605 | 89,060 | **291,900** |

| | |
|---|---|
| **Existing Appropriations** | **208,300** |
| **Sams Creek** | **0** |
| **Priestland Branch** | **208,300** |
| *PW 1 & PW3* | *166,000* |
| *Philips* | *42,300* |
| **Cherry Br./Little Pipe** | **0** |
| *Bowman Well* | *0* |

## Westminster Groundwater Budget

**Prepared by:** Carroll County Staff **Date:** 5/26/2009

| | Appropriation Watershed | | | WSA Totals |
|---|---|---|---|---|
| **Own & Control Type** | **Patapsco** | **Big Pipe Creek** | **Little Pipe Creek** | |
| **Size (ac)** | | | | |
| WSA Priority+Future | 4,256 | 1,129 | 3,158 | **8,543** |
| GAB | 5,855 | 1,260 | 3,736 | **10,851** |
| | | | | |
| **Recharge Rate (gpd/ac)** | **372** | **305** | **352** | |
| | | | | |
| **Own/Control Water (gpd)** | | | | |
| WSA Priority+Future | 1,498,112 | 397,408 | 1,111,616 | **3,007,136** |
| GAB | 2,060,960 | 443,520 | 1,315,072 | **3,819,552** |
| | | | | |
| **Existing Appropriations (gpd)** | **519,000** | **360,000** | **597,000** | **1,476,000** |
| | | | | |
| **Net Availability (gpd)** | | | | |
| WSA Priority+Future | 979,112 | 37,408 | 514,616 | **1,531,136** |
| GAB | 1,541,960 | 83,520 | 718,072 | **2,343,552** |

| **Existing Appropriations** | **1,476,000** | |
|---|---|---|
| **Patapsco** | **519,000** | |
| *4* | *170,000* | *Air Business Center* |
| *5* | *230,000* | *Krider's Church* |
| *8* | *119,000* | *Vo-Tech* |
| **Big Pipe Creek** | **360,000** | |
| *3* | *100,000* | *County Maintenance* |
| *9* | *125,000* | *Koontz Well* |
| *10* | | *Koontz Well* |
| *11* | *135,000* | *Roops mill* |
| **Little Pipe Creek** | **597,000** | |
| *1* | *197,000* | *Wakefield Well 1* |
| *2* | | *Wakefield Well 2* |
| *6* | *100,000* | *S. Center Street* |
| *7* | *300,000* | *Carfaro* |

**notes:**

1. *does not account for discharge from Koontz Creamery well which is 500,000 gpd flow augmentation in the Patapsco watershed*
2. *does not include Wakefield Valley golf course at 86,000 gpd in the Little Pipe Creek watershed*
3. *does not include existing Medford Quarry appropriation for mining.*

## Union Mills Groundwater Budget

**Prepared by:** Malcolm Pirnie **Date:** 8/17/2009

| | Appropriation Watershed | WSA Totals |
|---|---|---|
| **Own & Control Type** | **Big Pipe Creek** | |
| **Size (ac)** | | |
| WSA Priority+Future | 1,600 | **1,600** |
| GAB | 1,600 | **1,600** |
| | | |
| **Recharge Rate (gpd/ac)** | **305** | |
| | | |
| **Own/Control Water (gpd)** | | |
| WSA Priority+Future | 563,310 | **563,310** |
| GAB | 563,310 | **563,310** |
| | | |
| **Existing Appropriations (gpd)** | **0** | **0** |
| | | |
| **Net Availability (gpd)** | | |
| WSA Priority+Future | 563,310 | **563,310** |
| GAB | 563,310 | **563,310** |

| | |
|---|---|
| **Existing Appropriations** | **0** |
| **Big Pipe Creek** | **0** |

## Manchester Groundwater Budget

**Prepared by:** Carroll County Staff **Date:** 5/21/2009

| | Appropriation Watershed | | | WSA Totals |
|---|---|---|---|---|
| **Own & Control Type** | **Middle Potomac** | **Patapsco** | **Gunpowder** | |
| **Size (ac)** | | | | |
| WSA Priority+Future | 310 | 352 | 1,102 | **1,764** |
| GAB | 970 | 665 | 2,112 | **3,747** |
| | | | | |
| **Recharge Rate (gpd/ac)** | **352** | **352** | **352** | |
| | | | | |
| **Own/Control Water (gpd)** | | | | |
| WSA Priority+Future | 109,219 | 123,728 | 388,055 | **621,002** |
| GAB | 341,292 | 234,094 | 743,554 | **1,318,940** |
| | | | | |
| **Existing Appropriations (gpd)** | **134,000** | **123,000** | **324,000** | **581,000** |
| | | | | |
| **Net Availability (gpd)** | | | | |
| WSA Priority+Future | -24,781 | 728 | 64,055 | **64,783** |
| GAB | 207,292 | 111,094 | 419,554 | **737,940** |

| | |
|---|---|
| **Existing Appropriations** | **581,000** |
| | |
| **Middle Potomac** | **134,000** |
| *Bachman Road* | |
| *Crossroads 1* | |
| *Crossroads 2* | |
| *Hallie Hills* | |
| | |
| **Patapsco** | **123,000** |
| *Patricia Ct* | *38,000* |
| *Manchester Farms D* | *69,700* |
| *Manchester Farms B* | |
| *Park Ridge* | *6,000* |
| *Chauncey Hill* | *9,300* |
| | |
| **Gunpowder** | **324,000** |
| *walnut st spring/well* | |
| *route 30 (Lippy)* | |
| *Holland Drive* | |
| *Ferrier Road* | |
| *Black Farm* | |

## ESTIMATED WELL REQUIREMENTS - ASSUMPTIONS

**Drawdown Factor of Safety** 10%

**General Assumptions**

- data based on 1988 Carroll County Water Resources Study by R.E. Wright Associates
- maximum drawdown based on the measured distance between static water level and top of water bearing zone with a 10% factor of safety
- maximum pump rates based on septic capacities measured in WSA wells and calculated maximum drawdown
- total demand based on values presented in the GW Demands spreadsheet.
- number of wells is the total demand divided by the average pump rate of the well rounded up to the nearest integer value

- likely yield scenarios based on the MDE's understanding of hydrogeology in the vicinity of each of the WSAs
- median yield scenarios based on the median of published information
- optimistic yield scenarios based on the median of the maximum values for a given parameter where a range was specified
- lower yield scenarios based on the median of the minimum values for a given parameter where a range was specified

**Instructions**

1 set demands in blue box
2 adjust pump rates in red box to ensure total drawdown does not exceed acceptable drawdown

# HAMPSTEAD GROUNDWATER OPTION - ESTIMATED WELL REQUIREMENTS

**WITHDRAWAL SCENARIO**

| | LOWER YIELD | MEDIAN YIELD | OPTIMISTIC YIELD | AVG MDE APPROPRIATION | UNITS |
|---|---|---|---|---|---|
| **Static Head** | 4 | 28 | 149 | -- | ft - above aquifer bottom |
| **Aquifer Thickness** | 60 | 67 | 193 | -- | ft |
| **Specific Capacity** | 1.30 | 1.78 | 2.25 | -- | gpm/ft |
| **Acceptable Drawdown** | 19.8 | 34.1 | 47.7 | -- | ft |
| **Absolute Max Pump Rate** | 25.7 | 60.5 | 107.3 | -- | gpm |
| **Pumping Rate** | 25 | 55 | 100 | 19 | gpm |
| **Total Demand** | 528,000 | 528,000 | 528,000 | 528,000 | gpd |
| **Well Drawdown** | 19.2 | 31.0 | 44.4 | -- | ft |
| **Daily Pump Volume** | 36,000 | 79,200 | 144,000 | 27,619 | gpd |
| **Total Daily Pump Volume** | 540,000 | 554,400 | 576,000 | 552,381 | gpd |
| **Number of Wells** | 15 | 7 | 4 | 20 | -- |

**Notes:**

- Aquifer data based on Hampstead information presented in the 1988 Water Resources Study of Carroll County by R.E. Wright Associates

# MOUNT AIRY GROUNDWATER OPTION - ESTIMATED WELL REQUIREMENTS

**WITHDRAWAL SCENARIO**

| | LOWER YIELD | MEDIAN YIELD | OPTIMISTIC YIELD | AVG MDE APPROPRIATION | UNITS |
|---|---|---|---|---|---|
| **Static Head** | 23 | 145 | 266 | -- | ft - above aquifer bottom |
| **Aquifer Thickness** | 7 | 137 | 266 | -- | ft |
| **Specific Capacity** | 8.00 | 8.00 | 8.00 | -- | gpm/ft |
| **Acceptable Drawdown** | 11.7 | 14.4 | 18.0 | -- | ft |
| **Absolute Max Pump Rate** | 93.6 | 115.2 | 144.0 | -- | gpm |
| **Pumping Rate** | 40 | 75 | 75 | 60 | gpm |
| **Total Demand** | 364,000 | 364,000 | 364,000 | 364,000 | gpd |
| **Well Drawdown** | 5.0 | 9.4 | 9.4 | -- | ft |
| **Daily Pump Volume** | 57,600 | 108,000 | 108,000 | 86,500 | gpd |
| **Total Daily Pump Volume** | 403,200 | 432,000 | 432,000 | 432,500 | gpd |
| **Number of Wells** | 7 | 4 | 4 | 5 | -- |

**Notes:**

- Aquifer data based on Mount Airy information presented in the 1988 Water Resources Study of Carroll County by R.E. Wright Associates

- Storage coefficient values were estimated from regional values presented in Chapter 4 of 1988 study

# NEW WINDSOR GROUNDWATER OPTION - ESTIMATED WELL REQUIREMENTS

**WITHDRAWAL SCENARIO**

| | LOWER YIELD | MEDIAN YIELD | OPTIMISTIC YIELD | AVG MDE APPROPRIATION | UNITS |
|---|---|---|---|---|---|
| **Static Head** | 64 | 64 | 64 | -- | ft - above aquifer bottom |
| **Aquifer Thickness** | 1 | 1 | 1 | -- | ft |
| **Specific Capacity** | 15.00 | 15.00 | 15.00 | -- | gpm/ft |
| **Acceptable Drawdown** | 56.7 | 56.7 | 56.7 | -- | ft |
| **Absolute Max Pump Rate** | 850.5 | 850.5 | 850.5 | -- | gpm |
| **Pumping Rate** | 50 | 100 | 100 | 68 | gpm |
| **Total Demand** | 198,000 | 198,000 | 198,000 | 198,000 | gpd |
| **Well Drawdown** | 3.3 | 6.7 | 6.7 | -- | ft |
| **Daily Pump Volume** | 72,000 | 144,000 | 144,000 | 98,000 | gpd |
| **Total Daily Pump Volume** | 216,000 | 288,000 | 288,000 | 294,000 | gpd |
| **Number of Wells** | 3 | 2 | 2 | 3 | -- |

**Notes:**

- Aquifer data based on New Windsor information presented in the 1988 Water Resources Study of Carroll County by R.E. Wright Associates

## TANEYTOWN GROUNDWATER OPTION - ESTIMATED WELL REQUIREMENTS

**WITHDRAWAL SCENARIO**

| | LOWER YIELD | MEDIAN YIELD | OPTIMISTIC YIELD | AVG MDE APPROPRIATION | UNITS |
|---|---|---|---|---|---|
| **Static Head** | 22 | 295 | 496 | -- | ft - above aquifer bottom |
| **Aquifer Thickness** | 25 | 89 | 141 | -- | ft |
| **Specific Capacity** | 0.90 | 1.10 | 1.60 | -- | gpm/ft |
| **Acceptable Drawdown** | 45.9 | 72.9 | 243.0 | -- | ft |
| **Absolute Max Pump Rate** | 41.3 | 80.2 | 388.8 | -- | gpm |
| **Pumping Rate** | 40 | 80 | 380 | 51 | gpm |
| **Total Demand** | 1,164,000 | 1,164,000 | 1,164,000 | 1,164,000 | gpd |
| **Well Drawdown** | 44.4 | 72.7 | 237.5 | -- | ft |
| **Daily Pump Volume** | 57,600 | 115,200 | 547,200 | 72,875 | gpd |
| **Total Daily Pump Volume** | 1,209,600 | 1,267,200 | 1,641,600 | 1,166,000 | gpd |
| **Number of Wells** | 21 | 11 | 3 | 16 | -- |

**Notes:**

- Aquifer data based on Taneytown information presented in the 1988 Water Resources Study of Carroll County by R.E. Wright Associates

# UNION BRIDGE GROUNDWATER OPTION - ESTIMATED WELL REQUIREMENTS

**WITHDRAWAL SCENARIO**

| | LOWER YIELD | MEDIAN YIELD | OPTIMISTIC YIELD | AVG MDE APPROPRIATION | UNITS |
|---|---|---|---|---|---|
| **Static Head** | 64 | 216 | 530 | -- | ft - above aquifer bottom |
| **Aquifer Thickness** | 1 | 21 | 374 | -- | ft |
| **Specific Capacity** | 0.80 | 8.00 | 97.00 | -- | gpm/ft |
| **Acceptable Drawdown** | 59.4 | 137.7 | 252.9 | -- | ft |
| **Absolute Max Pump Rate** | 47.5 | 1101.6 | 24531.3 | -- | gpm |
| **Pumping Rate** | 47 | 200 | 200 | 72 | gpm |
| **Total Demand** | 594,000 | 594,000 | 594,000 | 594,000 | gpd |
| **Well Drawdown** | 58.8 | 25.0 | 2.1 | -- | ft |
| **Daily Pump Volume** | 67,680 | 288,000 | 288,000 | 104,150 | gpd |
| **Total Daily Pump Volume** | 609,120 | 864,000 | 864,000 | 624,900 | gpd |
| **Number of Wells** | 9 | 3 | 3 | 6 | -- |

**Notes:**

- Aquifer data based on Union Bridge information presented in the 1988 Water Resources Study of Carroll County by R.E. Wright Associates

# WESTMINSTER GROUNDWATER OPTION - ESTIMATED WELL REQUIREMENTS

**WITHDRAWAL SCENARIO**

| | LOWER YIELD | MEDIAN YIELD | OPTIMISTIC YIELD | AVG MDE APPROPRIATION | UNITS |
|---|---|---|---|---|---|
| **Static Head** | 75 | 216 | 530 | -- | ft - above aquifer bottom |
| **Aquifer Thickness** | 1 | 21 | 374 | -- | ft |
| **Specific Capacity** | 0.80 | 8.00 | 97.00 | -- | gpm/ft |
| **Acceptable Drawdown** | 59.4 | 137.7 | 252.9 | -- | ft |
| **Absolute Max Pump Rate** | 47.5 | 1101.6 | 24531.3 | -- | gpm |
| **Pumping Rate** | 45 | 200 | 550 | 93 | gpm |
| **Total Demand** | 1,176,000 | 1,176,000 | 1,176,000 | 1,176,000 | gpd |
| **Well Drawdown** | 56.3 | 25.0 | 5.7 | -- | ft |
| **Daily Pump Volume** | 64,800 | 288,000 | 792,000 | 134,182 | gpd |
| **Total Daily Pump Volume** | 1,231,200 | 1,440,000 | 1,584,000 | 1,207,636 | gpd |
| **Number of Wells** | 19 | 5 | 2 | 9 | -- |

**Notes:**

- Aquifer data based on Westminster information presented in the 1988 Water Resources Study of Carroll County by R.E. Wright Associates

# UNION MILLS AREA GROUNDWATER OPTION - ESTIMATED WELL REQUIREMENTS

**WITHDRAWAL SCENARIO**

| | LOWER YIELD | MEDIAN YIELD | OPTIMISTIC YIELD | AVG MDE APPROPRIATION | UNITS |
|---|---|---|---|---|---|
| **Static Head** | 75 | 216 | 530 | -- | ft - above aquifer bottom |
| **Aquifer Thickness** | 1 | 21 | 374 | -- | ft |
| **Specific Capacity** | 0.80 | 8.00 | 97.00 | -- | gpm/ft |
| **Acceptable Drawdown** | 59.4 | 137.7 | 252.9 | -- | ft |
| **Absolute Max Pump Rate** | 47.5 | 1101.6 | 24531.3 | -- | gpm |
| **Pumping Rate** | 45 | 200 | 550 | 43 | gpm |
| **Total Demand** | 563,310 | 563,310 | 563,310 | 563,310 | gpd |
| **Well Drawdown** | 56.3 | 25.0 | 5.7 | -- | ft |
| **Daily Pump Volume** | 64,800 | 288,000 | 792,000 | 61,750 | gpd |
| **Total Daily Pump Volume** | 583,200 | 576,000 | 792,000 | 617,500 | gpd |
| **Number of Wells** | 9 | 2 | 1 | 10 | -- |

**Notes:**

- Aquifer data based on Westminster information presented in the 1988 Water Resources Study of Carroll County by R.E. Wright Associates