COMMON SOURCES OF SODIUM CHLORIDE IN WATER SUPPLIES:

-- ATMOSPHERIC DEPOSITION
-- BEDROCK WEATHERING
-- WASTEWATER (SEPTIC SYSTEMS)
-- WATER SOFTENER DISCHARGE
-- OIL AND GAS DRILLING DISCHARGES
-- MINE DRAINAGE
-- INDUSTRIAL EFFLUENT
-- RESIDENTIAL/COMMERCIAL SIDEWALKS AND DRIVEWAYS
-- PARKING AREA DEICING CHEMICALS
-- ROAD AND HIGHWAY DEICING CHEMICALS
HISTORICAL CHLORIDE CONCENTRATION S AT BROWNS CROSSING AND BARROWS WELLFIELDS, WILMINGTON, MASSACHUSETTS

SECONDARY MCL FOR DRINKING WATER

CHLORIDE IN MG/L

DATE


I 93 OPENS

BARROWS WELLFIELD

BROWNS CROSSING WELLFIELD

2010-2012

HISTORICAL CHLORIDE CONCENTRATION S AT BROWNS CROSSING AND BARROWS WELLFIELDS, WILMINGTON, MASSACHUSETTS

CHLORIDE IN MG/L

DATE


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CHLORIDE IN MG/L

DATE


I 93 OPENS

BARROWS WELLFIELD

BROWNS CROSSING WELLFIELD

SECONDARY MCL FOR DRINKING WATER
BROWNS CROSSING WELLFIELD RAW WATER
SODIUM AND CHLORIDE CONCENTRATIONS
CERTIFIED LABORATORY RESULTS
WILMINGTON, MASSACHUSETTS
DECEMBER 1, 2009 TO FEBRUARY 29, 2012

CHLORIDE

SODIUM

20 MG/L -- STATE ADVISORY FOR SODIUM

250 MG/L

INTERSTATE 93 IN WILMINGTON, MASSACHUSETTS
LOOKING NORTH FROM ROUTE 62 OVERPASS

BROWNS CROSSING
WELLFIELD 2,000’ EAST

5 LANES

5 LANES
HUNDREDS OF CATCH BASINS COLLECT STORMWATER FROM PAVED SURFACES
I-93
STORMWATER OUTFALL
PART OF AN 11-ACRE PARKING AREA IN BROWNS CROSSING SWPA MANAGED BY PRIVATE CONTRACTORS WHO APPLIED APPROXIMATELY ONE TON/ACRE CHLORIDE IN 2010-2011.
89 STORMDRAINS DISCHARGE INTO STREAMS, WETLANDS AND GROUNDWATER WITHIN THE TWO WELLFIELDS’ AREAS OF CONTRIBUTION
Total Lane-Miles of Road Salting Routes

- (State): 16.68 Lane-Miles
- (Wilmington Main Runs): 5.31 Lane-Miles
- (Wilmington Occasional Runs): 2.43 Lane-Miles
- Impervious Lots Total Area (Private): 40.34 Acres

BROWNS CROSSING WELLFIELD

ROAD SALT LANE MILES

MASSDOT: 16.68 (68%)

WILMINGTON: 7.74 (32%)

PARKING AREAS: 40.34 AC
I-93 STORMWATER
CULVERT 2,000 FEET
UPSTREAM OF BROWNS CROSSING WELLFIELD
DATASONDES MEASURE TEMPERATURE AND SPECIFIC CONDUCTIVITY EVERY 15 MINUTES
CONDUCTIVITY DATASONDE
(15-MINUTE SAMPLE INTERVAL)
I-93 CULVERT

WINTER SW TOT: 2 TO 6.25 HOURS

I-93/ 8 LANES

BROWNS CROSSING WELLFIELD

I-93 CULVERT
Cl = 0.3688SC - 109.28
R² = 0.9932
n = 68

Chloride in mg/l vs. Specific Conductivity
Raw Well Water and Storm Water
Wilmington, Massachusetts

250 mg/l Chloride = 974 uS/cm
CHLORIDE IN SURFACE WATER AT BROWNS CROSSING WELLFIELD
WILMINGTON, MASSACHUSETTS -- NOVEMBER 28, 2010 TO JULY 12, 2011

CHLORIDE IN MG/L CALCULATED FROM SPECIFIC CONDUCTIVITY

- 250 MG/L
- 2000
- 1500
- 1000

9/29/2010 0:00
11/18/2010 0:00
1/7/2011 0:00
2/26/2011 0:00
4/17/2011 0:00
6/6/2011 0:00
7/26/2011 0:00

0
500
1000
1500
2000
2500
BROWNS CROSSING WELLFIELD

**BUILT IN 1928**

DESIGN CAPACITY: 1.55 MGD

UNTIL MARCH 2011, 42 FOUR-INCH WELLS IN A WETLAND RANGING FROM 53 TO 83 FEET DEPTH

**REPRESENTATIVE GEOLOGY:**

3 FEET OF PEAT

66 FEET COARSE SAND

14 FEET FINE TO COARSE GRAVEL OVER CAMBRIAN TO SILURIAN AGE METAMORPHIC BEDROCK (499-412 MY)
NEW BROWNS CROSSING WELLFIELD BEGAN OPERATION IN MARCH 2011
DESIGN CAPACITY: 1.2 MGD
16 WELLS INSTALLED ON DRY LAND
SCREENED FROM 61 TO 82 FEET DEPTH
BARROWS WELLFIELD

*Built in 1955*

Design capacity: 0.94 MGD

35 four-inch diameter driven wells

Boosted to 1.0 MGD in 1960 with 20 more wells

Connected to Sargent WTP in 1989

Wellfield now pumping at 0.36 MGD with 45 wells

*Representative geology*

Peat: 7-13 feet thick

Fine to coarse sand and gravel

Metamorphic fractured rock from 23 to 34 feet depth
I-93 STORMWATER CULVERT BUILT IN 1960, JUST 800 FEET UPSTREAM FROM BARROWS WELLFIELD
ROAD SALT PULSE FROM I-93 TO BARROWS WELLFIELD
SNOWSTORM OF APRIL 1, 2011

PULSE TOT: 09:00 AM TO 1:30 PM = 4.5 HOURS
DILUTION = 61%
1. DELINEATE THE SOURCE WATER PROTECTION AREA.

2. MAP ALL ROADS AND PARKING AREAS.

3. DIFFERENTIATE STATE, LOCAL AND PRIVATE ROADS AND PARKING AREAS.

4. MAP NUMBER OF LANE-MILES/ACRES FOR EACH CATEGORY.

5. DETERMINE WINTER SALT LOADINGS IN TONS PER LANE MILE/ACRE.

6. MULTIPLY LANE-MILES/ACRES BY APPLICATION RATES.

7. CREATE A PIE CHART SHOWING SECTOR PERCENTAGES.

8. GRAPH MULTI-YEAR LOADING HISTORY TO OBSERVE SEASONAL VARIABILITY AND TRENDS OVER TIME.
SALT ROUTE MAP
COURTESY OF THE WILMINGTON DPW
FOR BROWNS CROSSING SWPA -- WINTER 2010 -2011

SWPA BOUNDARY

WELLFIELD

MUNICIPAL
MAIN RUNS: 
OCCASIONAL SUBDIVISION RUNS: 
PRIVATE PROPERTY
(TREATMENT UNKNOWN):

STATE
STATE TREATMENT ROUTES: 
WATER DEPT.
(NO TREATMENT):
## REPORTED ROAD SALT LOADINGS BY SECTOR
### WINTER OF 2010-2011

<table>
<thead>
<tr>
<th>SECTOR</th>
<th>WELLFIELD</th>
<th>LOADING RATE (TONS/LANE-MILE)</th>
<th>LANE MILES</th>
<th>ROAD SALT (TONS)</th>
<th>CHLORIDE (TONS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MASSDOT (I-93):</td>
<td></td>
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<tr>
<td>BROWNS CROSSING</td>
<td>24.94</td>
<td>16.68</td>
<td>416</td>
<td>250</td>
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<td>BARRIOS</td>
<td>24.94</td>
<td>5.63</td>
<td>140</td>
<td>84</td>
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<td>WILMINGTON:</td>
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<td>BROWNS CROSSING</td>
<td>16.45</td>
<td>7.74</td>
<td>127</td>
<td>76</td>
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<tr>
<td>BARRIOS</td>
<td>16.45</td>
<td>4.73</td>
<td>78</td>
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<tr>
<td>PARKING AREAS:</td>
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<tr>
<td>BROWNS CROSSING</td>
<td>1 TON/ACRE</td>
<td>37.6 ACRES</td>
<td>37.6</td>
<td>---</td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL:** 495 TONS
SECTOR CHLORIDE LOADINGS IN BROWNS CROSSING SOURCE WATER PROTECTION AREA WINTER OF 2010 – 2011

- PARKING AREAS APPROX. 38 TONS (10%)
- WILMINGTON 76 TONS (21%)
- MASSDOT 250 TONS (69%)
SECTOR CHLORIDE LOADINGS IN BARROWS SOURCE WATER PROTECTION AREA WINTER OF 2010 – 2011

WILMINGTON: 47 TONS

36%

64%

MASSDOT: 84 TONS
SUMMARY
- NEARLY 500 TONS OF CHLORIDE WERE APPLIED DURING THE WINTER OF 2010-2011 ON ROADS AND PARKING LOTS IN THE BROWNS CROSSING AND BARROWS SOURCE WATER PROTECTION AREAS:
  MASS. DOT CONTRIBUTION: 69%
  WILMINGTON CONTRIBUTION: 21%
  PRIVATE PARKING AREAS: 10%

- SINCE I-93 OPENED IN 1960, CHLORIDE LEVELS IN WELLFIELD RAW WATER HAVE INCREASED MORE THAN 40 TIMES FROM <10 TO AS MUCH AS 400 MG/L, WELL ABOVE THE SECONDARY MCL OF 250 MG/L.

- CHLORIDE AT BARROWS WELLFIELD INCREASED FROM 250 TO 400 MG/L DURING FEBRUARY, 2011 DUE TO INDUCED INFILTRATION OF SALINE STORMWATER.

- ON FEBRUARY 28, 2011, SODIUM IN BARROWS RAW WATER REACHED A CALCULATED MAXIMUM OF 240 MG/L, OR TWELVE TIMES THE STATE’S ADVISORY LEVEL OF 20 MG/L.

- DATASONDES SHOW THAT SALINE I-93 STORMWATER AVERAGED 3.6 HOURS TO REACH BROWNS CROSSING AND 10.6 HOURS TO REACH BARROWS WELLFIELD.
POTENTIAL REMEDIATION STRATEGIES

STATE DESIGNATES REDUCED-SALT APPLICATION ZONE FOR I-93 IN WELLFIELD RECHARGE AREAS

STATE AND LOCAL SALT-REDUCTION BMPS IMPLEMENTED

STORMWATER DIVERTED BEYOND WELLS

CONNECTION TO ALTERNATIVE WATER SUPPLY

DRINKING WATER TREATMENT
Thank You!

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