COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY
Street address: 629 East Main Street, Richmond, Virginia 23219
Mailing address: P.O. Box 1105, Richmond, Virginia 23218
www.deq.virginia.gov

Molly Joseph Ward
Secretary of Natural Resources

David K. Paylor
Director

(804) 698-4020
1-800-592-5482

June 28, 2016

SENT VIA E-MAIL: Mike.Collins@harrisonburg.va.gov
RECEIPT CONFIRMATION REQUESTED

City of Harrisonburg
c/o Mr. A. Mike Collins, Director of Public Utilities
21255 Beery Road
Harrisonburg, Virginia 22801

Re: Virginia Water Protection (VWP) Individual Permit Number 16-0730
City of Harrisonburg Public Water System, Rockingham County, Virginia
Notice of Final Permit

Dear Mr. Collins:

Pursuant to the VWP Permit Program Regulation 9 VAC 25-210-10 and § 401 of the Clean Water Act Amendments of 1977, Public Law 95-217, the Department of Environmental Quality has enclosed the VWP Individual Permit for the "City of Harrisonburg Public Water System" project.

This permit is valid for 15 years from the date of issuance. No re-issuance or extension of the permit may occur, as the permit term cannot exceed the maximum of 15 years.

As provided by Rule 2A:2 of the Supreme Court of Virginia, you have **30 calendar days** from the date of service (the date you actually received this decision or the date it was mailed to you, whichever occurred first) within which to appeal this decision by filing a notice of appeal in accordance with the Rules of the Supreme Court of Virginia with the Director, Department of Environmental Quality. In the event that this decision is served on you by mail, three days are added to that period. Refer to Part 2A of the Rules of the Supreme Court of Virginia for additional requirements governing appeals from administrative agencies.

Alternatively, an owner may request a formal hearing for the formal taking of evidence upon relevant fact issues under Section 2.2-4020 of the Administrative Process Act. A petition for a formal hearing must meet the requirements set forth in 9 VAC 25-230-130.B of the Virginia Administrative Code. In cases involving actions of the board, such petition must be filed within 30 calendar days after notice of such action is sent to such owner by certified mail.

Should you have any questions, please contact Brian McGurk at (804) 698-4180, Brian.McGurk@deq.virginia.gov, or at the above address.

Respectfully,

Scott W. Kudlas
Director, Office of Water Supply

Enclosures: Permit Cover Page, Part I - Special Conditions, Part II - General Conditions, Attachment A, Permit Fact Sheet

cc: VDH Office of Drinking Water – VIA EMAIL

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

VWP Individual Permit Number 16-0730
Effective Date: June 28, 2016
Expiration Date: June 28, 2031

VIRGINIA WATER PROTECTION PERMIT ISSUED PURSUANT TO THE STATE WATER CONTROL LAW AND SECTION 401 OF THE CLEAN WATER ACT

Based upon an examination of the information submitted by the owner, and in compliance with § 401 of the Clean Water Act as amended (33 USC 1341 et seq.) and the State Water Control Law and regulations adopted pursuant thereto, the State Water Control Board (board) has determined that there is a reasonable assurance that the activity authorized by this permit, if conducted in accordance with the conditions set forth herein, will protect instream beneficial uses and will not violate applicable water quality standards. The board finds that the effect of the impact, together with other existing or proposed impacts to surface waters, will not cause or contribute to a significant impairment to state waters or fish and wildlife resources.

Permittee: City of Harrisonburg

Address: c/o Mr. A. Mike Collins,
2155 Beery Road
Harrisonburg, Virginia 22801

Activity Location: The project consists of three separate existing surface water intakes that comprise an integrated surface water supply project. These intakes are 1) the South Fork intake on the South Fork of the Shenandoah River, 2) the North River intake on the North River, and 3) the Dry River intake on the Dry River near Rawley Springs. All three intakes are located in Rockingham County.

Activity Description: The City of Harrisonburg proposes to continue operation of an integrated surface water withdrawal system to withdraw surface water at the following intake locations:

a. South Fork Intake on the South Fork of the Shenandoah River
b. North River intake on the North River, a tributary to the South Fork of the Shenandoah River
c. Dry River intake on the Dry River, a tributary to the North River

The permitted activity shall be in accordance with this Permit Cover Page, Part I - Special Conditions, and Part II - General Conditions.

Director, Office of Water Supply

6/28/16
Date

Part I – Special Conditions

A. Authorized Activities

1. This permit authorizes the operation of an integrated surface water supply project to withdraw surface water at the following intake locations as described in Part I.D:
    a. South Fork Intake on the South Fork of the Shenandoah River
    b. North River intake on the North River, a tributary to the South Fork of the Shenandoah River
    c. Dry River intake on the Dry River, a tributary to the North River
2. Authorized activities shall be conducted as described in the Joint Permit Application dated July 2, 2014 and received July 2, 2014, as well as supplemental materials, revisions and clarifications received through January 29, 2016.

3. The permittee shall notify the DEQ prior to any impacts to surface waters, including wetlands; and of any modifications to any of the intake structures. Any additional impacts, modifications, or changes shall be subject to individual permit review and/or modification of this permit.

B. Permit Term

1. This permit is valid for fifteen (15) years from the date of issuance. A new permit may be necessary for the continuance of the authorized activities, including water withdrawals, or any permit requirement that has not been completed. If the authorized activities will continue beyond the expiration date of the permit, submittal of an application for reissuance shall be made within 180 days of the date of permit expiration.

C. Standard Project Conditions

1. The activities authorized by this permit shall be executed in such a manner that any impacts to beneficial uses are minimized. As defined in § 62.1-10(b) of the Code, "beneficial use" means both instream and offstream uses. Instream beneficial uses include, but are not limited to, the protection of fish and wildlife habitat, maintenance of waste assimilation, recreation, navigation, and cultural and aesthetic values. Offstream beneficial uses include, but are not limited to, domestic (including public water supply), agricultural, electric power generation, commercial, and industrial uses. Public water supply uses for human consumption shall be considered the highest priority.

2. No activity shall substantially disrupt the movement of aquatic life indigenous to the water body, including those species that normally migrate through the area, unless the primary purpose of the activity is to impound water.

3. Flows downstream of the project area shall be maintained to protect all uses.

4. Virginia Water Quality Standards shall not be violated in any surface waters as a result of the project activities.

5. All required notifications and submittals shall include project name and permit number and be submitted to the DEQ office stated below, to the attention of the Water Withdrawal Permit Manager, unless directed in writing by DEQ subsequent to the issuance of this permit: Department of Environmental Quality-Office of Water Supply, P.O. Box 1105, Richmond, Virginia 23219.

6. All reports required by this permit and other information requested by DEQ shall be signed by the permittee or a person acting in the permittee's behalf, with the authority to bind the permittee. A person is a duly authorized representative only if *both* criteria below are met. If a representative authorization is no longer valid because of a change in responsibility for the overall operation of the facility, a new authorization shall be immediately submitted to DEQ.

   a. The authorization is made in writing by the permittee.

   b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, superintendent, or position of equivalent responsibility. A duly authorized representative may thus be either a named individual or any individual occupying a named position.

7. All submittals shall contain the following signed certification statement:

   a. "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

8. Any fish kills or spills of fuels or oils shall be reported to DEQ immediately upon discovery at (804) 698-4000. If DEQ cannot be reached, the spill shall be reported to the Virginia Department of Emergency Management (DEM) at 1-800-468-8892 or the National Response Center (NRC) at 1-800-424-8802.

9. DEQ shall be notified in writing within 24 hours or as soon as possible on the next business day when potential environmentally threatening conditions are encountered which require debris removal or involve potentially toxic substances. Measures to remove the obstruction, material, or toxic substance or to change the location of any structure are prohibited until approved by DEQ.

D. Surface Water Withdrawals

1. Surface water withdrawn from the South Fork of the Shenandoah River, the Dry River and the North River and authorized under this permit shall be only used for public water supply.

2. The safe yield of the surface water withdrawal project as authorized under this permit is the annual average daily volume of 11.88 million gallons per day (mgd).

3. The combined total withdrawal of water from the permittee's intakes on the South Fork of the Shenandoah River, the North River and the Dry River shall not exceed the limits established in the table below. The withdrawal limits described as Tier 2 are to be phased in based upon documentation of a higher total demand growth rate in comparison with that used to forecast the Tier 1 withdrawal volume and/or completion of service agreements and related capital improvements necessary to begin water service to new customers that would cause demand to exceed the Tier 1 limits.

Tier	Maximum Daily Withdrawal (mgd)	Maximum Annual Withdrawal (mg)
1	12.24	3158
2	15.33	4348

   a. Tier 1 contains the withdrawal limits to meet the justified demands of the Harrisonburg service area for the 15-year permit period ending in 2031.

   b. Tier 2 contains the withdrawal limits to meet the justified demands of the service area identified in Tier 1, plus additional demands documented by the submittal of one or more signed agreements for new customers and/or documentation of increased service to previously unserved portions of the City's service area.

4. The permittee may submit to DEQ for review and approval a request for authorization of withdrawal limits established for Tier 2. Any such request shall include a justification for the requested increase in allowable withdrawal volumes. Justification shall consist of one or more of the following:
   a. Sales or usage records over a minimum period of five years that indicate an increasing trend in demand growth rate that would cause the Tier 1 withdrawal limits to be exceeded prior to the permit expiration date,
   b. A signed agreement(s) for providing water service to new commercial, industrial or municipal customer(s) that would cause the Tier 1 withdrawal limits to be exceeded prior to the permit expiration date ,
   c. A schedule for completion of capital improvements needed to supply water to new commercial, industrial or municipal customer(s) identified in Part I.D.4.b prior to the permit expiration date.

   Upon review and approval by DEQ of the request, the allowable maximum daily and maximum annual withdrawal volumes shall equal those listed for Tier 2 in Part I.D.3. If the justification for an increase in withdrawal limits indicates that the demand will exceed the Tier 1 limits, but not reach the Tier 2 limits listed in Part I.D. 3 within the 15-year permit term, DEQ may revise the Tier 2 limits to equal the revised demand projected for the end of the permit term. Unless and until a request is made and approved for Tier 2 limits, the total allowable withdrawal volumes equal the Tier 1 values in Part. I.D.3.

South Fork Intake:

5. The permittee shall estimate stream flows at the South Fork Intake in units of cubic feet per second (cfs) on a daily basis by monitoring the stream flow gage described below and by applying the equation "Flows at the intake = Q_{SF} * 1.01," where:

    a. Q_{SF} is the previous day's provisional mean daily flow at the DEQ gage no. 01628500 (South Fork Shenandoah River near Lynnwood, VA);

    b. 1.01 is the adjustment factor for drainage area.

6. At no time shall Net Withdrawals from the South Fork Intake exceed 10% of the stream flow at the South Fork Intake as estimated using the equation described by Part I.D.5, where:
    a. Net Withdrawal = the total volume withdrawn from the South Fork intake minus Return Flow, where
    b. Return Flow = ($Flow_{SFI}$ * 0.1) * 0.66, where
    c. $Flow_{SFI}$ = flow at the South Fork Intake estimated as described by Part I.D.5, and 0.66 represents the approximate portion of the total withdrawal returned to the South Fork of the Shenandoah River upstream via treated wastewater discharge
    d. Example calculation for the lowest recorded flow at DEQ gage no. 01628500 (84 cfs):
        i. FlowSFI = 84 * 1.01 = 84.8 cfs
        ii. Return Flow = (84.8 * 0.1) *.0.66 = 5.6 cfs
        iii. Maximum Net Withdrawal = 84.8 * 0.1 = 8.5 cfs
        iv. Maximum Total Withdrawal = 8.5 + 5.6 = 14.1 cfs (9.1 mgd)

    .

North River Intake:

7. The permittee shall estimate flows at the North River Intake in cfs on a daily basis by monitoring the stream flow gage described below and by applying the equation "Flows at the intake = Q_{NR} * 0.75," where:

    a. Q_{NR} is the previous day's provisional mean daily flow at the DEQ gage no. 01622000 (North River near Burketown, VA);

    b. 0.75 is the adjustment factor for drainage area.

8. At no time shall withdrawals from the North River Intake exceed 12% of the stream flow at the North River Intake as estimated using the equation described by Part I.D.7.
    a. Example calculation for the lowest recorded daily mean flow at DEQ gage no. 01622000:
        i. Flow at the North River intake = 22 cfs * 0.75 = 16.5 cfs
        ii. Maximum allowable withdrawal from the North River Intake = 16.5 cfs * 0.12 = 2 cfs (1.3 mgd)

Dry River Intake:

9. The permittee shall estimate flows in the Dry River in cfs on a daily basis and adjust withdrawals from the Dry River intake so that a minimum of 0.774 cfs (0.5 mgd) is released to the Dry River

below the low-head dam at the Dry River intake. No withdrawals will be allowed from this intake if the estimated flow at the intake is 0.774 cfs or less

10. The permittee shall submit a plan to DEQ review and approval for monitoring stream flow at the Dry River intake within 120 days of permit issuance. The monitoring plan shall contain, at a minimum:

    a. A detailed description of the methodology used to monitor flow at the location of the intake to ensure that withdrawals will be in compliance with Part I.D.9.
    b. A detailed design and description of any existing or planned structure(s) to be used or installed for stream flow monitoring at the intake location.

Intake Screens and Drought Management:

11. Within two years of permit issuance, the permittee shall submit for DEQ review and approval a plan to install new screens at the South Fork intake, the North River intake and the Dry River intake in order to protect aquatic species from impingement and entrainment. The plan shall include, at a minimum:

    a. A schedule for installing new screens at each intake that are designed so that screen openings are not larger than 1 millimeter in width and height and the screen face intake velocities are not greater than 0.25 feet per second. The permittee may propose alternative screen mesh and intake velocity designs for each intake. For each alternative design proposed, the plan shall include an entrainment/impingement monitoring strategy. Each entrainment/impingement monitoring strategy shall be designed with the input of the Virginia Department of Game and Inland Fisheries (VDGIF) and shall include a schedule for implementation of entrainment/impingement monitoring. The results of the impingement/entrainment monitoring shall be submitted to DEQ and VDGIF for review and approval. If the monitoring results indicate that the proposed alternative design is not protective of aquatic species, maximum screen openings of 1 millimeter in width and height and a maximum screen face intake velocity of 0.25 feet per second will be required.
    b. Detailed design plans for each intake that will allow withdrawals at the maximum allowable rates while remaining in compliance with Part I.D.11.a.

12. The permittee shall submit a drought management plan to DEQ for review and approval within 120 days of permit issuance. Any future revisions to the approved plan shall be submitted to DEQ for review and approval prior to implementing the change. The plan shall include, at a minimum, the following:

    a. Development of drought stages, including when and how each stage will be implemented. The emergency drought stage shall be initiated when a drought emergency is declared by the Commonwealth of Virginia in the Shenandoah Drought Evaluation Region or by either Rockingham County or the City of Harrisonburg in compliance with either municipality's Drought Management Ordinance.
    b. A description of the conservation measures to be implemented during each drought stage.

13. When a drought emergency is declared by the Commonwealth of Virginia in the Shenandoah Drought Evaluation Region or by either Rockingham County or the City of Harrisonburg in accordance with either municipality's Drought Management Ordinance, the permittee shall implement either the provisions directed by the Commonwealth, the Drought Management Ordinance, the Drought Management Plan required by Part I.D.13 of this permit or the mandatory conservation measures as detailed in Attachment A of this permit, whichever is the most restrictive. The permittee shall be responsible for determining when drought emergencies are declared. The permittee shall retain records documenting that mandatory conservation measures were implemented during declared drought emergencies.

E. Monitoring, Recordation and Reporting Conditions

1. The permittee shall monitor withdrawals from the South Fork of the Shenandoah River, the North River and the Dry River on a daily basis using flow totalizer technology to confirm that the withdrawals at each intake are in compliance with this permit. Such meters shall produce volume determinations within plus or minus 10% of actual flows. A defective meter or other device must be repaired or replaced within 60 days. A defective meter is not grounds for not reporting the withdrawals. During any period when a meter is defective, generally accepted engineering practice shall be used to estimate withdrawals and the period during which the meter was defective must be clearly identified in the report.

2. On each day that pumping occurs, the permittee must monitor and record the following, for each intake:

   a. Date and time.

   b. Total amount of water withdrawn each day.

   c. The maximum rate of withdrawal that occurred each date (in gpm).

   d. The provisional stream flow in cfs as measured at the following stream gages: DEQ gage no. 01628500 (South Fork Shenandoah River near Lynnwood, VA) and DEQ gage no. 01622000 (North River near Burketown, VA)

   e. The provisional stream flow at the South Fork intake and at the North River intake in cfs as estimated in accordance with Part I.D.5 and Part I.D.7, respectively

   f. The stream flow at the Dry River intake in cfs as estimated in accordance with Part I.D.9

3. The permittee shall submit a water withdrawal monitoring report to DEQ semi-annually. The semi-annual monitoring period shall be as follows: January through June and July through December. The daily records shall be tabulated by month. The report shall be submitted to DEQ by January 31st and July 31st of every year within the permit term. Submittal of the report may take the form of electronic reporting or another form determined to be acceptable by DEQ. In the

event the electronic reporting system is not available, the permittee may submit the report by electronic mail. The report shall include the following information:

a. The permittee's name and address.

b. The permit number.

c. The source(s) from which water is withdrawn.

d. The location (latitude and longitude) of the water withdrawal.

e. Information listed in Part I.E.2.

f. The cumulative volume (million gallons) of water withdrawn each month and for the calendar year.

g. The average daily volume (mgd) of water withdrawn as calculated the last day of the monitoring period.

h. In the last report for the calendar year, the largest single day withdrawal volume (mgd) that occurred in the year and the month in which it occurred.

i. The method of measuring each withdrawal.

j. If during a semi-annual reporting period a drought emergency is declared, the report shall include a summary of mandatory conservation measures implemented during the drought event.

4. Water withdrawal monitoring and reporting activities shall comply with this section, Part I.C, and Part II. All records and information that result from the monitoring and reporting activities required by this permit, including any records of maintenance activities to the withdrawal system, shall be retained for the life of the permit. This period of retention shall be extended automatically during the course of any unresolved litigation regarding the regulated activity or as requested by the State Water Control Board.

Part II – General Conditions

A. Duty to Comply

The permittee shall comply with all conditions of the VWP permit. Nothing in the VWP permit regulations shall be construed to relieve the permittee of the duty to comply with all applicable federal and state statutes, regulations and prohibitions. Any VWP permit violation is a violation of the law, and is grounds for enforcement action, VWP permit termination, revocation, modification, or denial of an application for a VWP permit extension or reissuance.

B. Duty to Cease or Confine Activity

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the activity for which a VWP permit has been granted in order to maintain compliance with the conditions of the VWP permit.

C. Duty to Mitigate

The permittee shall take all reasonable steps to minimize or prevent any impacts in violation of the permit which may have a reasonable likelihood of adversely affecting human health or the environment.

D. VWP Permit Action

1. A VWP permit may be modified, revoked and reissued, or terminated as set forth in 9 VAC 25-210 et seq.

2. If a permittee files a request for VWP permit modification, revocation, or termination, or files a notification of planned changes, or anticipated noncompliance, the VWP permit terms and conditions shall remain effective until the request is acted upon by the board. This provision shall not be used to extend the expiration date of the effective VWP permit. If the permittee wishes to continue an activity regulated by the VWP permit after the expiration date of the VWP permit, the permittee must apply for and obtain a new VWP permit or comply with the provisions of 9 VAC 25-210-185 (VWP Permit Extension).

VWP permits may be modified, revoked and reissued or terminated upon the request of the permittee or other person at the board's discretion, or upon board initiative to reflect the requirements of any changes in the statutes or regulations, or as a result of VWP permit noncompliance as indicated in the Duty to Comply subsection above, or for other reasons listed in 9 VAC 25-210-180 (Rules for Modification, Revocation and Reissuance, and Termination of VWP permits).

E. Inspection and Entry

Upon presentation of credentials, any duly authorized agent of the board may, at reasonable times and under reasonable circumstances:

1. Enter upon any permittee's property, public or private, and have access to, inspect and copy any records that must be kept as part of the VWP permit conditions;

2. Inspect any facilities, operations or practices (including monitoring and control equipment) regulated or required under the VWP permit; and

3. Sample or monitor any substance, parameter or activity for the purpose of ensuring compliance with the conditions of the VWP permit or as otherwise authorized by law.

F. Duty to Provide Information

1. The permittee shall furnish to the board any information which the board may request to determine whether cause exists for modifying, revoking, reissuing or terminating the VWP permit, or to determine compliance with the VWP permit. The permittee shall also furnish to the board, upon request, copies of records required to be kept by the permittee.

2. Plans, specifications, maps, conceptual reports and other relevant information shall be submitted as required by the board prior to commencing construction.

G. Monitoring and Records Requirements

1. Monitoring of parameters, other than pollutants, shall be conducted according to approved analytical methods as specified in the VWP permit. Analysis of pollutants will be conducted according to 40 CFR Part 136 (2000), Guidelines Establishing Test Procedures for the Analysis of Pollutants.

2. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.

3. The permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart or electronic recordings for continuous monitoring instrumentation, copies of all reports required by the VWP permit, and records of all data used to complete the application for the VWP permit, for a period of at least three years from the date of the expiration of a granted VWP permit. This period may be extended by request of the board at any time.

4. Records of monitoring information shall include:

   a. The date, exact place and time of sampling or measurements;

   b. The name of the individuals who performed the sampling or measurements;

   c. The date and time the analyses were performed;

d. The name of the individuals who performed the analyses;

e. The analytical techniques or methods supporting the information such as observations, readings, calculations and bench data used;

f. The results of such analyses; and

g. Chain of custody documentation.

H. Transferability

This VWP permit may be transferred to a new permittee only by modification to reflect the transfer, by revoking and reissuing the permit, or by automatic transfer. Automatic transfer to a new permittee shall occur if:

1. The current permittee notifies the board within 30 days of the proposed transfer of the title to the facility or property;

2. The notice to the board includes a written agreement between the existing and proposed permittee containing a specific date of transfer of VWP permit responsibility, coverage and liability to the new permittee, or that the existing permittee will retain such responsibility, coverage, or liability, including liability for compliance with the requirements of any enforcement activities related to the permitted activity; and

3. The board does not within the 30-day time period notify the existing permittee and the new permittee of its intent to modify or revoke and reissue the VWP permit.

I. Property rights

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize injury to private property or any invasion of personal rights or any infringement of federal, state or local law or regulation.

J. Reopener

Each VWP permit shall have a condition allowing the reopening of the VWP permit for the purpose of modifying the conditions of the VWP permit to meet new regulatory standards duly adopted by the board. Cause for reopening VWP permits includes, but is not limited to when the circumstances on which the previous VWP permit was based have materially and substantially changed, or special studies conducted by the board or the permittee show material and substantial change, since the time the VWP permit was issued and thereby constitute cause for VWP permit modification or revocation and reissuance.

K. Compliance with State and Federal Law

Compliance with this VWP permit constitutes compliance with the VWP permit requirements of the State Water Control Law. Nothing in this VWP permit shall be construed to preclude the institution of any legal action under or relieve the permittee from any responsibilities, liabilities, or other penalties established pursuant to any other state law or regulation or under the authority preserved by § 510 of the Clean Water Act.

L. Severability

The provisions of this VWP permit are severable.

M. Permit Modification

A VWP permit may be modified, but not revoked and reissued except when the permittee agrees or requests, when any of the following developments occur:

1. When additions or alterations have been made to the affected facility or activity which require the application of VWP permit conditions that differ from those of the existing VWP permit or are absent from it;

2. When new information becomes available about the operation or activity covered by the VWP permit which was not available at VWP permit issuance and would have justified the application of different VWP permit conditions at the time of VWP permit issuance;

3. When a change is made in the promulgated standards or regulations on which the VWP permit was based;

4. When it becomes necessary to change final dates in schedules due to circumstances over which the permittee has little or no control such as acts of God, materials shortages, etc. However, in no case may a compliance schedule be modified to extend beyond any applicable statutory deadline of the Act;

5. When changes occur which are subject to "reopener clauses" in the VWP permit; or

6. When the board determines that minimum instream flow levels resulting from the permittee's withdrawal of water are detrimental to the instream beneficial use and the withdrawal of water should be subject to further net limitations or when an area is declared a Surface Water Management Area pursuant to §§ 62.1-242 through 62.1-253 of the Code of Virginia, during the term of the VWP permit.

N. Permit Termination

After notice and opportunity for a formal hearing pursuant to Procedural Rule No. 1 (9 VAC 25-230-100) a VWP permit can be terminated for cause. Causes for termination are as follows:

1. Noncompliance by the permittee with any condition of the VWP permit;

2. The permittee's failure in the application or during the VWP permit issuance process to disclose fully all relevant facts or the permittee's misrepresentation of any relevant facts at any time;

3. The permittee's violation of a special or judicial order;

4. A determination by the board that the permitted activity endangers human health or the environment and can be regulated to acceptable levels by VWP permit modification or termination;

5. A change in any condition that requires either a temporary or permanent reduction or elimination of any activity controlled by the VWP permit; and

6. A determination that the permitted activity has ceased and that the compensatory mitigation for unavoidable adverse impacts has been successfully completed.

O. Civil and Criminal Liability

Nothing in this VWP permit shall be construed to relieve the permittee from civil and criminal penalties for noncompliance.

P. Oil and Hazardous Substance Liability

Nothing in this VWP permit shall be construed to preclude the institution of legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under § 311 of the Clean Water Act or §§ 62.1-44.34:14 through 62.1-44.34:23 of the State Water Control Law.

Q. Unauthorized Discharge of Pollutants

Except in compliance with this VWP permit, it shall be unlawful for the permittee to:

1. Discharge into state waters sewage, industrial wastes, other wastes, or any noxious or deleterious substances;

2. Excavate in a wetland;

3. Otherwise alter the physical, chemical, or biological properties of state waters and make them detrimental to the public health, to animal or aquatic life, to the uses of such waters for domestic or industrial consumption, for recreation, or for other uses;

4. On or after October 1, 2001 conduct the following activities in a wetland:

a. New activities to cause draining that significantly alters or degrades existing wetland acreage or functions;

b. Filling or dumping;

c. Permanent flooding or impounding;

d. New activities that cause significant alteration or degradation of existing wetland acreage or functions.

R. Permit Extension

Any permittee with an effective VWP permit for an activity that is expected to continue after the expiration date of the VWP permit, without any change in the activity authorized by the VWP permit, shall submit written notification requesting an extension. The permittee must file the request prior to the expiration date of the VWP permit. Under no circumstances will the extension be granted for more than 15 years beyond the original effective date of the VWP permit. If the request for extension is denied, the VWP permit will still expire on its original date and, therefore, care should be taken to allow for sufficient time for the board to evaluate the extension request and to process a full VWP permit modification, if required.

Attachment A – Water Conservation

Mandatory Non-essential Water Use Restrictions

The following non-essential water uses will be prohibited during periods of declared drought emergencies. Please note the exceptions that follow each prohibited use. These prohibitions and exceptions will apply to uses from all sources of water and will only be effective when the Governor of Virginia or the Virginia Drought coordinator declares a Drought Emergency. Water use restrictions shall not apply to the agricultural production of food or fiber, the maintenance of livestock including poultry, nor the commercial production of plant materials, *provided that best management practices are applied to assure the minimum amount of water is utilized*.

1. ***Unrestricted irrigation of lawns is prohibited.***

   - Newly sodded and seeded areas may be irrigated to establish cover on bare ground at the minimum rate necessary for no more than a period of 60 days. Irrigation rates may not exceed one inch of applied water in any 7-day period.

   - Gardens, bedding plants, trees, shrubs and other landscape materials may be watered with hand held containers, hand held hoses equipped with an automatic shutoff device, sprinklers or other automated watering devices at the minimum rate necessary but in no case more frequently than twice per week. Irrigation should not occur during the heat of the day.

   - All allowed lawn irrigation must be applied in a manner to assure that no runoff, puddling or excessive watering occurs.

   - Irrigation systems may be tested after installation, routine maintenance or repair for no more than ten minutes per zone.

2. ***Unrestricted irrigation of golf courses is prohibited.***

   - Tees and greens may be irrigated between the hours of 9:00 p.m. and 10:00 a.m. at the minimum rate necessary.

   - Localized dry areas may be irrigated with a hand held container or hand held hose equipped with an automatic shutoff device at the minimum rate necessary.

   - Greens may be cooled by syringing or by the application of water with a hand held hose equipped with an automatic shutoff device at the minimum rate necessary.

   - Fairways may be irrigated between the hours of 9:00 p.m. and 10:00 a.m. at the minimum rate necessary not to exceed one inch of applied water in any ten-day period.

- Fairways, tees and greens may be irrigated during necessary overseeding or resodding operations in September and October at the minimum rate necessary. Irrigation rates during this restoration period may not exceed one inch of applied water in any seven-day period.

- Newly constructed fairways, tees and greens and areas that are re-established by sprigging or sodding may be irrigated at the minimum rate necessary not to exceed one inch of applied water in any seven-day period for a total period that does not exceed 60 days.

- Fairways, tees and greens may be irrigated without regard to the restrictions listed above so long as:

    - The only water sources utilized are water features whose primary purpose is stormwater management;

    - Any water features utilized do not impound permanent streams;

    - During declared Drought Emergencies these water features receive no recharge from other water sources such as ground water wells, surface water intakes, or sources of public water supply; and,

    - All irrigation occurs between 9:00 p.m. and 10:00 a.m.

- All allowed golf course irrigation must be applied in a manner to assure that no runoff, puddling or excessive watering occurs.

- Rough areas may not be irrigated.

3. ***Unrestricted irrigation of athletic fields is prohibited.***

- Athletic fields may be irrigated between the hours of 9:00 p.m. and 10:00 a.m. at a rate not to exceed one inch per application or more than a total of one inch in multiple applications during any ten-day period. All irrigation water must fall on playing surfaces with no outlying areas receiving irrigation water directly from irrigation heads.

- Localized dry areas that show signs of drought stress and wilt (curled leaves, foot-printing, purpling) may be syringed by the application of water for a cumulative time not to exceed fifteen minutes during any twenty four hour period. Syringing may be accomplished with an automated irrigation system or with a hand held hose equipped with an automatic shutoff device at the minimum rate necessary.

- Athletic fields may be irrigated between the hours of 9:00 p.m. and 10:00 a.m. during necessary overseeding, sprigging or resodding operations at the minimum rate necessary for a period that does not exceed 60 days. Irrigation rates during this restoration period may not exceed one inch of applied water in any seven-day period. Syringing is permitted during signs of drought stress and wilt (curled leaves, foot-printing, purpling).

- All allowed athletic field irrigation must be applied in a manner to assure that no runoff, puddling or excessive watering occurs.

- Irrigation is prohibited on athletic fields that are not scheduled for use within the next 120-day period.

- Water may be used for the daily maintenance of pitching mounds, home plate areas and base areas with the use of hand held containers or hand held hoses equipped with an automatic shutoff device at the minimum rate necessary.

- Skinned infield areas may utilize water to control dust and improve playing surface conditions utilizing hand held containers or hand held hoses equipped with an automatic shutoff device at the minimum rate necessary no earlier than two hours prior to official game time.

4. ***Washing paved surfaces such as streets, roads, sidewalks, driveways, garages, parking areas, tennis courts, and patios is prohibited.***

- Driveways and roadways may be pre-washed in preparation for recoating and sealing.

- Tennis courts composed of clay or similar materials may be wetted by means of a hand-held hose equipped with an automatic shutoff device at the minimum rate necessary for maintenance. Automatic wetting systems may be used between the hours of 9:00 p.m. and 10:00 a.m. at the minimum rate necessary.

- Public eating and drinking areas may be washed using the minimum amount of water required to assure sanitation and public health.

- Water may be used at the minimum rate necessary to maintain effective dust control during the construction of highways and roads.

5. ***Use of water for washing or cleaning of mobile equipment including automobiles, trucks, trailers and boats is prohibited.***

- Mobile equipment may be washed using hand held containers or hand held hoses equipped with automatic shutoff devices provided that no mobile equipment is washed more than once per calendar month and the minimum amount of water is utilized.

- Construction, emergency or public transportation vehicles may be washed as necessary to preserve the proper functioning and safe operation of the vehicle.

- Mobile equipment may be washed at car washes that utilize reclaimed water as part of the wash process or reduce water consumption by at least 10% when compared to a similar period when water use restrictions were not in effect.

- Automobile dealers may wash cars that are in inventory no more than once per week utilizing hand held containers and hoses equipped with automatic shutoff devices, automated equipment that utilizes reclaimed water as part of the wash process, or automated equipment where water consumption is reduced by at least 10% when compared to a similar period when water use restrictions were not in effect.

- Automobile rental agencies may wash cars no more than once per week utilizing hand held containers and hoses equipped with automatic shutoff devices, automated equipment that utilizes reclaimed water as part of the wash process, or automated equipment where water consumption is reduced by at least 10% when compared to a similar period when water use restrictions were not in effect.

- Marine engines may be flushed with water for a period that does not exceed 5 minutes after each use.

6. ***Use of water for the operation of ornamental fountains, artificial waterfalls, misting machines, and reflecting pools is prohibited.***

    - Fountains and other means of aeration necessary to support aquatic life are permitted.

7. ***Use of water to fill and top off outdoor swimming pools is prohibited.***

    - Newly built or repaired pools may be filled to protect their structural integrity.

    - Outdoor pools operated by commercial ventures, community associations, recreation associations, and similar institutions open to the public may be refilled as long as:

        - Levels are maintained at mid-skimmer depth or lower;

        - Any visible leaks are immediately repaired;

        - Backwashing occurs only when necessary to assure proper filter operation;

        - Deck areas are washed no more than once per calendar month (except where chemical spills or other health hazards occur);

        - All water features (other than slides) that increase losses due to evaporation are eliminated; and

        - Slides are turned off when the pool is not in operation.

    - Swimming pools operated by health care facilities used in relation to patient care and rehabilitation may be filled or topped off.

- Indoor pools may be filled or topped off.

- Residential swimming pools may be filled only to protect structural integrity, public welfare, safety and health and may not be filled to allow the continued operation of such pools.

8. ***Water may be served in restaurants, clubs, or eating-places only at the request of customers.***

June 28, 2016

FACT SHEET
Virginia Water Protection Individual Permit No. 16-0730
City of Harrisonburg Public Water System, Rockingham County, Virginia

---

The Department of Environmental Quality (DEQ) has reviewed the application for reissuance of Virginia Water Protection (VWP) Individual Permit Number 16-1730 and has determined that the project qualifies for an individual permit. Based on the information provided in the application and in compliance with §401 of the Clean Water Act as amended (33 USC 1341 et seq.) and the State Water Control Law (Code of Virginia §§62.1-44.2 through 62.1-34.28) and regulations (9VAC25-210, et seq.), DEQ has determined that there is a reasonable assurance that the activity authorized by this permit will protect instream beneficial uses, will not violate applicable water quality standards, and will not cause or contribute to significant impairment of state waters or fish and wildlife resources, provided the permittee complies with all permit conditions. Surface water impacts have been avoided and minimized to the maximum extent practicable.

The following details the application review process and summarizes relevant information for developing the Part I - Special Conditions for permit issuance.

1. Contact Information:

Permittee Legal Name and Address:

City of Harrisonburg
2155 Beery Rd
Harrisonburg, VA 22801
Attn: Mr. A. Mike Collins, MSE, PE
Mike.Collins@harrisonburg.va.gov
540-434-9959

Property Owner Name and Address:
City of Harrisonburg
2155 Beery Rd
Harrisonburg, VA 22801
Attn: Mr. A. Mike Collins, MSE, PE
Mike.Collins@harrisonburg.va.gov
540-434-9959

Agent Legal Name and Address:

City of Harrisonburg
2155 Beery Rd
Harrisonburg, VA 22801
Attn: Mr. A. Mike Collins, MSE, PE
Mike.Collins@harrisonburg.va.gov
540-434-9959

2. JPA Processing Dates:

Received Application:	July 2, 2014
Joint Publication with VMRC of Received JPA:	N/A (see Section 12)
Application Complete:	August 26, 2014
Processing Deadline (120 days from Complete Application):	December 26, 2014
Letter(s) sent to Local Government(s):	July 14, 2014
Letters sent to Commissioner of Revenue:	n/a, online search
Letters sent to VDH, VDGIF, VDCR, VMRC:	July 11, 2014
1st Request for Additional Information Sent:	July 22, 2014
Letters sent to Riparian Land Owners:	July 15, 2014
Response to 1st Request for Additional Information Received:	August 15, 2014
2nd Request for Additional Information Sent (via phone):	August 15, 2014
Reminder: 2nd Request for Additional Information	October 29, 2014
Response to 2nd Request for Additional Information Received:	November 25, 2014
3rd Request for Additional Information Sent:	February 2, 2015
Response to 3rd Request for Additional Information Received:	April 29, 2015 & May 5, 2015
4th Request for Additional Information Sent:	November 2, 2015 (via phone)
Response to 4th Request for Additional Information Received:	November 12, 2015 (via meeting) and December 29, 2015, January 29, 2016
Permit Fee Deposited by Accounting:	August 26, 2014
Draft Permit Package Issued:	May 16, 2016
Copy of Public Notice sent to DEQ Central Office:	May 19, 2016
Copy of Public Notice sent to Admin. Board Planning:	May 19, 2016
Public Notice Published:	May 28, 2016
End of 30-Day Public Comment Period:	June 27, 2016
Received Verification of Publication:	June 3, 2016

3. Project Location:

The project consists of three separate existing surface water intakes that comprise an integrated surface water supply project. These intakes are 1) the South Fork intake, 2) the North River intake, and 3) the Dry River intake.

South Fork Intake (SFI):
The South Fork intake is located on the north bank of the South Fork of the Shenandoah River in Rockingham County, Virginia. The location is southeast of Harrisonburg near McGaheysville and can be accessed via Power Dam Road (County Rte 651).

City/County:	RockinghamCounty
Waterbody:	South Fork Shenandoah River
Basin:	Shenandoah River
Subbasin:	South Fork Shenandoah River
Section:	3
Class:	IV

Special Standards:	pH 6.5-9.5, ESW-16
HUC:	02070005
Latitude & Longitude (of intake):	38º20'11"N, -78º43'25"W
U.S.G.S. Quadrangle:	McGaheysville
State Watershed No.:	PS32
TMDL Status:	None

North River Intake (NRI):
The North River intake is situated within the North River in Rockingham County at a location upstream of the SFI. The site can be accessed via East Riverside Drive just south of the Town of Bridgewater.

City/County:	Rockingham County
Waterbody:	North River
Basin:	Shenandoah River
Subbasin:	South Fork Shenandoah River
Section:	5b
Class:	IV
Special Standards:	PWS, pH-6.5-9.5
HUC:	02070005
Latitude & Longitude (of intake):	38º22'9"N, -78º58'11"W
U.S.G.S. Quadrangle:	Bridgewater
State Watershed No.:	PS25
TMDL Status:	None

Dry River Intake (DRI):
The Dry River intake is also located in Rockingham County and is upstream of both the SFI and the NRI on the Dry River at Rawley Springs. The site can be accessed via Rte 33 north of Harrisonburg.

City/County:	Rockingham County
Waterbody:	Dry River
Basin:	Shenandoah River
Subbasin:	South Fork Shenandoah River
Section:	5c
Class:	IV
Special Standards:	PWS
HUC:	02070005
Latitude & Longitude (of intake):	38º31'14"N, -78º3'26"W
U.S.G.S. Quadrangle:	Rawley Springs
State Watershed No.:	PS18
TMDL Status:	None

4. Project Description:

Project Purpose
The City of Harrisonburg (City) proposes the withdrawal of surface water from the three existing intakes for public supply purposes to meet the water supply demands of the City. Raw water withdrawn from the three sources will supply a single integrated water supply system via the City's water treatment facility.

On July 2, 2014, the City of Harrisonburg (City) requested an extension of VWP Permit 98-1672, which authorized construction and withdrawal from a surface water intake on the South Fork of the Shenandoah River for municipal water supply. The original permit was made effective on August 27, 1999 with a 10-year permit term, and was modified on February 1, 2008 to extend the term of the permit for an additional five years. The extended permit term expired on August 26, 2014, and, per 9VAC25-210-185, a VWP permit cannot be extended beyond a term of 15 years. The application is, therefore, being reviewed as a reissuance of the permit with a new application number (16-0730).

Withdrawal from the South Fork intake, which was previously authorized under VWP permit 98-1672, will not occur until the pipeline extension project to connect the intake to the City's water system has been completed. Withdrawals from the NRI and DRI sources were previously excluded from the VWP permitting requirements. However, with the inclusion of the SFI into the City's integrated public water supply infrastructure, total authorized system withdrawal has increased and all three sources have been incorporated into the proposed permit.

Existing Water Supply System

The City currently withdraws water from the NRI and DRI intakes described above. According to the Upper Shenandoah Water Supply Plan (USWSP) dated November, 2011 and attached to the Joint Permit Application (JPA), flow to the latter intake is derived from a low-head dam across the Dry River and an underground infiltration gallery. Flow to this intake is also supplemented by releases of water from storage in the Switzer Dam near the headwaters of the Dry River. The NRI pump station is capable of producing 7.6 mgd, while the Dry River intake/Switzer Dam combination is currently capable of producing 5.5 mgd. The Dry River and North River are both tributaries to the South Fork of the Shenandoah River.

5. Water Withdrawal Use, Need and Demand:

Purpose of Water Uses

The USWSP and the City's Draft Raw Water System Management Plan (RWSMP, submitted to DEQ on May 5, 2015), indicate that all three intakes will supply water to the City's centralized public water supply treatment plant. The City's raw water optimization strategy, described in the RWSMP, is to fully integrate all three withdrawal sources so that daily raw water supply can be optimized in response to drought and system breakdowns. It is anticipated that this integration will occur during the 15-year permit term. Therefore, all three withdrawal sources were incorporated into the permit evaluation and permit conditions.

The application for the initial VWP permit 98-1672 for the SFI, issued in 1999, was spurred by a potential petition by the Town of Bridgewater for designation of a Surface Water Management Area within the region that included the new intake location. The modified VWP permit that expired in August, 2014 contained a condition (Part I. F.1) that the maximum daily withdrawal from the SFI shall not exceed 4.0 mgd, with the following exception: The maximum daily withdrawal from the SFI may increase to 8.0 mgd provided the combined same day withdrawal from the NRI and DRI withdrawals is less than or equal to 8.0 mgd.

Section 27 of the Joint Permit Application regarding the use and need for the withdrawal referred to the USWSP, stating that the withdrawal water is to be used in accordance with the USWSP. The USWSP (page 2-18) describes the proposed withdrawal project by explaining the above-described condition in VWP permit 98-1672. This condition was described further by the City in its response to a request for additional information dated August 15, 2014. Staff reviewed the requested withdrawal using the water demand forecasted for Years 2030 and 2040 for the entire City of Harrisonburg water system because the new intake would be used in conjunction with the City's other existing intakes. The demand for the Year 2030 was reviewed because it is near the end of the 15-year permit term. Any proposed permit limits will be based on water demand projections for the end of the 15-year permit term.

Basis of Need

The City's population is anticipated to continue to grow steadily over the time period reviewed in the USWSP. The table below lists the City's projected population growth for the planning period. The USWSP projections assume the same rate of growth as was experienced from 2000 to 2010. The Weldon Cooper methodology uses a multilevel regression model that makes use of all census population estimates from 1950 to 2010.

Table 1. Population Projections

Year	City of Harrisonburg	
	USWSP Plan(1)	**Weldon Cooper(2)**
2000	40,468	40,468
2010	48,914	48,914
2020	60,154	57,114
2030	73,977	65,768
2040	90,977	75,015

Notes:
(1) Obtained from Table 5-32: Current and Project Population Estimates – City of Harrisonburg, Upper Shenandoah Water Supply Plan dated November, 2011.
(2) Projections published by the Weldon Cooper Center for Public Service, Demographics and Workforce Group on November 13, 2012; downloaded from www.coopercenter.org/demographics, 12/31/15 (2000 and 2010 values from Census).

According to information listed in Chapter 12 of the City's Comprehensive Plan adopted May 10, 2011, the City's customers for water are primarily residential and commercial users (67% of 2007 average annual demand). In their response to a request for additional information dated August 15, 2014, the City stated that they expected increased growth in residential use due to population growth along with significant growth in the number of larger customers over the next several years. This expectation was reiterated by the City in a letter response to a request for their comments on modeling analysis results dated December 15, 2015 and received on December 18, 2015.

Water Demand Projection

In the JPA, the applicant's stated need for the intake is to provide potable water to the City's customers in accordance with the USWSP. The USWSP lists projected average annual water demands of 9.57 mgd in 2030 and 11.04 mgd for 2040, assuming a 2.5% annual average growth rate over the planning period from 2006.

The applicant supplied additional information in the August 15, 2014 response from Chapter 12 of the City's 2011 Comprehensive Plan that outlined how the City's future demands at build out were estimated (Table 2). Demands from the year 2007 were added to additional future demand estimated for development of presently undeveloped land both within the City and rural lands outside of the City for certain landowners with contract commitments and for small areas along the Route 33 and Route 701 corridors. Wholesale future demand includes a current contract with Rockingham County for 0.5 mgd that is expandable to 1.0 mgd. The expansion of this contract to supply water to Rockingham County was assumed. The build-out demand values listed in Table 2 were revised in the Updated RWSMP dated January 28, 2016 and received by DEQ on January 29, 2016.

Table 2. Summary of Harrisonburg projected build-out average daily demand (mgd) by customer type.

Category	2007 Demand	Projected Increase in Demand	Projected Demand at Build-out[1]	Revised Build-out Demand[2]
Within City (primarily residential)	4.61	3.75	8.00	8.36
Rural outside City	0.63	0.37	1.00	1.00
Wholesale (Rockingham County)	0.17	0.83	1.00	1.00
Commercial customers (Michaels, Daley)	0.00	0.26	0.00	0.26
Water Treatment Backwash	0.17	0.09	0.28	0.26
Water Loss	1.17	-0.17	1.00	1.00
Total	6.75	5.13	11.28	11.88

[1] From August 15, 2014 response to additional information.
[2] From Updated RWSMP dated January 28, 2016

In their responses, the City explained that future growth in average annual demand could vary between 0.5% and 2.5% per year and that the demand at the end of the 15-year permit term would depend upon the actual growth rate achieved. However, the applicant also provided a range of updated average daily demand projections for 2030 and 2040 in the responses to requests for additional information received August 15, 2014 and November 25, 2014. The applicant stated in the November 25, 2014 response that the 1.0% growth rate was the most likely scenario.

Table 3. City of Harrisonburg Projected Future Average Daily Demand (mgd)

Year/Annual Growth Rate	Upper Shenandoah WSP	Harrisonburg Updated
2030/0.5%	-	7.99
2040/0.5%	-	8.40
2030/1.0%	-	8.54
2040 1.0%	-	9.43
2030/2.5%	9.57	10.42
2040/2.5%	11.04	11.28

Because the City's water use has been and is projected to remain primarily for residential use, the future average annual demand projections were checked in an approximate fashion by computing an approximate per capita daily use for several previous and future years (Table 4). Per capita use rates

computed using the ratio of the projected future average annual demands with corresponding Weldon-Cooper population projections are roughly the same as those calculated using reported total Harrisonburg system withdrawals and reported Weldon-Cooper population estimates for recent years. Because the end of the 15-year permit term would be 2031, the projected average annual demand was determined by linearly interpolating between the 2030 and 2040 projections that assumed a 1% per year growth rate. Therefore, the resulting projected system-wide average annual demand for 2031 of 8.63 mgd for the 15-year permit term is justified.

Table 4. Estimated Per Capita Water Use Rates: City of Harrisonburg

Year	Reported Total System Avg Annual Withdrawal (mgd)	Projected Total System Avg Annual Demand (mgd)	Population (1)	Estimated Per Capita Demand (gpcd)
1990	5.635		30707	184
1995	6.051		36000	168
2000	6.78		40468	168
2005	6.44		44326	145
2010	6.347		48914	130
2014	6.572		52612	123
2020		6.88	57114	125
2030		8.54	65768	130
2040		9.43	75015	126

(1) From www.coopercenter.org/demographics

In the JPA, the City proposed maximum daily, monthly and annual withdrawal volumes of 8.0 mg, 240 mg and 2920 mg, respectively, from only the SFI. However, because of the system integration, the justification of maximum daily and annual withdrawal volumes was made for the entire surface water withdrawal system. In a letter dated December 15, 2015 and received on December 18, 2015, the applicant requested a system-wide daily maximum raw water withdrawal volume of 15.3 mg. This daily maximum volume was revised upward to 15.33 mg in the updated RWSMP dated January, 28, 2016. This projection was derived from the City's most recent projections for its build-out condition. The applicant requested that no maximum annual withdrawal volume be applied as a condition of the permit, citing concerns regarding uncertainty in the rate of growth. The uncertainty stems primarily from potential industrial customers that might abruptly increase the total system demand beyond what is currently projected for 2031 based upon a 1% per year growth rate. There is concern that a higher growth rate in demand plus new industrial customers could result in average daily demand reaching the average annual build-out rate of 11.88 mgd during the 15-year permit term.

In their response to a request for additional information dated November 25, 2014, the City explained that, for their system, the ratio between the maximum daily demand for treated water and the average annual demand for treated water may be as high as a factor of 1.6. However, due to system storage and reductions in weekend water usage, the projected ratio of maximum daily raw water demand to average daily raw water demand is 1.33. This ratio was revised downward to 1.29 in the updated RWSMP submitted to DEQ by the City on January 29, 2016. The City's maximum daily withdrawals reported to the Virginia Water Use Database (VWUDS) during the recent 5-year period (2010-2014) reached 6.2 million gallons (mg) at North River and 4.48 mgd at Dry River, with a combined annual average for the

period of 6.40 mgd. If it's assumed that these maximum withdrawals occurred on the same day, the peak/average ratio would be (6.2+4.48)/6.40 = 1.67. However, with the addition of the South Fork intake to the system and the stated need to optimize withdrawals between the three sources, it is unlikely that the maximum daily withdrawals from each intake would be coincident on the same day. Therefore, the updated ratio of 1.29 was accepted.

To account for the uncertainty in both the assumed annual growth rate and the potential for the introduction of new industrial customers during the 15-year permit term, staff evaluated the City's system-wide demand using projections derived from both 1% and 2.5% growth rates listed in Table 3:

Growth rate 1%, 2031 projection:

- Average Daily: 8.63 mgd
- Peak (maximum) day: 8.63 x 1.29 x 1.10 = 12.24 mgd
  - Peak Day Factor (1.29) obtained from application and supporting documentation.
  - VDH certification added (10 percent capacity)
- Maximum Annual: (8.63 x 366) = 3158 mg

Growth rate of 2.5%, build-out projection:

- Average Daily: 11.88 mgd
- Peak (maximum) day: 11.88 x 1.29 x 1.10 = 16.86 mgd
  - Peak Day Factor (1.29) obtained from application and supporting documentation.
  - With VDH certification added (10 percent capacity)
- Peak (maximum) day without VDH certification: 11.88 x 1.29 = 15.33 mgd
- Maximum Annual: (11.88 x 366) = 4348 mg

The peak day raw water withdrawal (16.86 mgd) for the build-out projection that results from adding an additional 10% for VDH certification is greater than the requested peak day withdrawal rate of 15.33 mgd; and it is also greater than the maximum daily system-wide raw water withdrawal rate that can be achieved during the drought of record while maintaining instream flow criteria (see Section 7 below and Appendix A). Therefore, the requested and calculated water demand volumes for the public water supply withdrawal system listed in Table 5 below do not include VDH certification for the peak (maximum) daily raw water demand for the build-out projection (Tier 2).

Table 5: Requested Water Demands and Calculated Withdrawal Limits

	Requested Water Demand Volumes for Permit Term	Staff Calculated Withdrawal Limits Tier 1 (1)	Staff Calculated Withdrawal Limits (Tier 2) (1)
Average Daily Volume (mgd)	-	8.63	11.88
Peak Day Volume (mgd)	15.33	12.24	15.33
Maximum Annual Volume (mg)	-	3158	4348

Note:
(1)See the Withdrawal Limitations and Instream Flow Requirement subsection under Section 7 below.

The system-wide volumes calculated above by staff will be used as the basis for any potential permit drafted for this project. (See the Withdrawal Limitations and Instream Flow Requirement subsection under Section 7 below.)

Staff concluded that the water demand and statement of need is reasonable and has been adequately justified by the application through the information submitted in the VWP permit application process.

6. Alternatives Reviewed:

The applicant referred to the alternatives presented by the USWSP that was attached to the application and also supplied similar information in the RWSMP regarding alternatives. These consist of 1) continuing to supply water only from the Dry River and North River sources that are connected to the City's single water treatment plant, 2) completion of the SFI connection so that all three sources are part of one integrated surface water withdrawal system, and 3) incorporation of the Silver Lake source that is owned by the City but currently contracted for use by the Town of Dayton into the existing system. The RWSMP states that the use of Silver Lake would require coordination with Dayton and rehabilitation of a pump station. It also mentions that this source could only be used to supplement the other sources and may not be viable during droughts. The USWSP states that completion of the second alternative (integration of the SFI with the DRI and NRI) will allow the City to meet its 2040 demand. The second alternative was considered to be the preferred one by the applicant. Staff determined that the preferred alternative was practicable.

7. Water Withdrawal Volumes and Instream Flow Requirements:

Staff reviewed the proposed withdrawal using the water demand volumes forecasted for the year 2031, which represented the end of the 15-year permit term. Projected build-out demands were also evaluated to estimate the safe yield of the surface water withdrawal system.

<u>Water Withdrawal Volumes Requested in JPA</u>
The applicant requested authorization for a maximum daily system-wide withdrawal volume of 15.33 million gallons.

<u>Return Flow</u>
Backwash from ponds at the City's Water Treatment Plant (WTP), which averages approximately 0.027 mgd, is permitted under Permit # VA000674 of the Virginia Pollution Discharge Elimination System (VPDES) Permit Program. These ponds discharge to Cooks Creek, which is a tributary to the North River. Much of the water withdrawn by the City's surface water withdrawal system is treated and discharged at the Harrisonburg Rockingham Regional Sewer Authority (HRRSA) wastewater plant on the North River and at the Virginia Poultry Growers Cooperative (VPGC) facility on Muddy Creek (a tributary to the Dry River). The applicant stated that the lowest ratio of total wastewater discharge to system-wide water withdrawal on record was 70%. The applicant anticipates that this proportion of return flow to withdrawal will remain approximately the same through the permit period. However, the City also provided information in the JPA that 82% of the projected build-out withdrawal rates would supply sewered areas. For the cumulative impact analysis a 20% consumptive use rate was assumed to occur within these areas during low flow (drought) periods. Therefore, a ratio of total discharge to total

withdrawal of 66% (80% of the JPA's noted 82%) was used in the cumulative impact analysis (Appendix A).

Cumulative Impact Analysis

A cumulative impact analysis was conducted by staff on the proposed water withdrawal. This analysis reviewed the withdrawal volumes requested to evaluate any potential cumulative impacts to existing beneficial uses and existing water users and determine instream flow requirements to limit any impacts to those existing beneficial uses. Based upon the results of the analysis, staff determined the proposed project as limited in the draft permit, will protect existing beneficial uses while meeting the permittee's purpose and need.

A summary of staff's modeling analysis is attached to this fact sheet (Appendix A).

Permit Withdrawal Limitations and Instream Flow Criteria

The permit limits surface water withdrawals to the volume justified based upon the application materials submitted and staff modeling analyses. Based upon this information, the permit proposes the following limits on the withdrawal volumes that are partially based upon the completion of capital improvements to areas proposed to be serviced by the City, as identified in the JPA and additional informational submittals.

- The total withdrawal of water from the Dry River, the North River and the South Fork of the Shenandoah River shall not exceed the limits established in the table below. The withdrawal limits are to be phased in based upon documentation of a higher total demand growth rate in comparison with that used to forecast the Tier 1 withdrawal volume and/or completion of service agreements and related capital improvements necessary to begin water service to new customers that would cause demand to exceed the Tier 1 limits:

Tier	Maximum Daily Withdrawal (mgd)	Maximum Annual Withdrawal (mg)
1	12.24	3158
2	15.33	4348

  a. Tier 1 contains the withdrawal limits to meet the justified demands of the Harrisonburg service area for the 15-year permit period ending in 2031.

  b. Tier 2 contains the withdrawal limits to meet the justified demands of the service areas identified in Tier 1, plus additional demands documented by the submittal of one or more signed agreements for new large-scale customers at and/or documentation of increased service to previously unserved portions of the City's service area.

The permit also limits withdrawals to no greater than an estimated flowby value at each intake location:

- The permittee shall estimate flows at or just below the DRI in units of cubic ft per second (cfs) on a daily basis and adjust withdrawals so that a minimum of 0.774 cfs (0.5 mgd) is released to the Dry River below the low-head dam at the intake. No withdrawals will be allowed if the estimated flow at the intake is 0.774 cfs or less. The condition requiring a flowby of 0.5 mgd at the DRI is a

continuation of the same flowby that the City maintains at this intake that was derived via a previous agreement with the Virginia Department of Game and Inland Fisheries (DGIF).

- The permittee shall estimate flows at the NRI in cfs on a daily basis by monitoring stream flow at the DEQ gage no. 01622000 (North River near Burketown, VA) and applying the equation *"Flows at the NRI = Q_{NR} * 0.75", where Q_{NR} is the previous day's provisional mean daily flow at gage no. 01622000.* At no time shall withdrawals from the NRI exceed 12% of the previous day's provisional mean daily flow at gage no. 01622000.
- The permittee shall estimate flows at the South Fork of the SFI in cfs on a daily basis by monitoring stream flow at the DEQ gage no. 01628500 (South Fork Shenandoah River near Lynnwood, Va) and applying the equation *"Flows at the SFI = Q_{SF} * 1.01", where Q_{SF} is the previous day's provisional mean daily flow at gage no. 01628500.* At no time shall net withdrawals from the SFI exceed 10% of the previous day's estimated flow stream flow. The net withdrawal equals the total withdrawal minus the volume of flow returned to the river by the HRRSA, the VPGC and the City's wastewater plant, all of which are located upstream of gage no. 01628500.

Safe Yield of the System

The safe yield of a surface water withdrawal project is the maximum volume of water that can be withdrawn on an average daily basis during the drought of record (for the area in which the withdrawal is located) to meet the needs of the project while still protecting the other existing beneficial uses of the waterbody. This value is subject to change if a new drought of record occurs, or if changes to withdrawal limitations in the permit are considered to protect beneficial uses. The safe yield value for the City's water supply system includes the condition that all three intakes have been combined into a single network in which daily withdrawals from the individual intakes can fluctuate depending upon local conditions. It should be noted that this value does not represent the total volume of water present at the City's intakes during the drought of record.

The safe yield of the City's surface water supply system was determined based upon the operating rules included in the permit under the conditions of the drought of record for the area in which the project is located. The safe yield of the surface water supply system under these operating rules is the annual average daily volume of 11.88 mgd based upon the 1998 - 2002 drought of record. The Tier 2 maximum annual withdrawal volume was derived by multiplying this safe yield value by 366 days/year.

See Attachment A for more information on the determination of the safe yield.

8. Water Supply Plan Review:

The JPA was coordinated with DEQ Water Supply Planning staff on July 11, 2014, who responded on July 24, 2014. The City incorporated the USWSP into the JPA, as described above. Also, as described above, the USWSP addresses the need and adequacy of the City's surface water withdrawal system. It also notes that its 2040 projections for the City are based on completion of the "Shenandoah project" (connection of the SFI to the integrated system). It was also noted that the USWSP documents the City's water shortage (drought and emergencies) ordinance.

9. Surface Water Impacts:

The proposed withdrawal activity does not anticipate any additional surface water impacts.

Water quality impacts are expected to be temporary and minimal provided the permittee abides by the conditions of the permit.

10. Compensation for Unavoidable Impacts:

Compensation is not required because impacts to surface waters are not proposed.

11. Site Inspection:

A site visit was conducted on March 11, 2015 during which no compliances issues or concerns were noted. A summary of the site inspection is located in VWP Permit File No. 98-1672.

12. Relevant Regulatory Agency Comments:

As part of the application review process, DEQ contacted the appropriate state regulatory agencies. Any relevant agency comments were addressed in the VWP individual permit Part I - Special Conditions. Therefore, the staff anticipates no adverse effect on water quality and fish and wildlife resources provided the applicant adheres to the permit conditions.

Summary of State Agency Comments and Actions
By email dated July 11, 2014, comments were requested from the following state agencies: Virginia Department of Game and Inland Fisheries (DGIF), Virginia Department of Conservation and Recreation (DCR), Virginia Marine Resources Commission (VMRC), and Virginia Department of Health (VDH). Failure to provide comments within 45 calendar days of the DEQ request for comments infers that the agency has no comments on the project activities.

VDH
VDH corresponded with DEQ on July 17, 2014 with a question regarding the permit history for the SFI. Upon DEQ's response, VDH replied on the same day that they had no comments at that time, but requested an opportunity to review and comment on the proposed permit reissuance if the withdrawal limits are reduced.

With the City's proposal to incorporate the SFI into its integrated public water supply infrastructure, total authorized system withdrawal has increased and all three of the City's surface water intakes have been incorporated into the proposed permit. Therefore, DEQ coordinated with VDH regarding this change to the application on February 2, 2016.

VMRC
VMRC did not respond to the DEQ request for comments on the JPA. However, VMRC copied DEQ on a letter to the applicant dated August 11, 2014 that stated that no permit was required from VMRC for the project, provided that no additional structures were constructed within the ordinary high water limits of the South Fork of the Shenandoah River.

DGIF

DGIF provided comments to DEQ by email dated August 4, 2014; the comments are summarized below:

- According to DGIF records, Big Run and Onemile Run are located in the project area and are designated wild trout waters. Based on the scope and location of the proposed work, they did not anticipate that the project would cause adverse impacts upon these resources.
- To protect the aquatic environment and its residents from harm associated with habitat loss, DGIF recommended that no more than 10% instantaneous flow be withdrawn from the South Fork Shenandoah River at any given time. To protect resident aquatic species from impingement and entrainment, DGIF recommended that the intake be fitted with a 1 mm mesh screen and that the intake velocity not exceed 0.25 fps. DGIF also recommended further coordination with them if the application is unable to adhere to these recommendations.

The special conditions of the permit address this recommendation for all three intake locations. The applicant expressed concern that the existing SFI structure, which contains 2 mm screens, was originally designed with the cooperation of DGIF and that changing the existing structure may not be cost effective. Part I.D.11a contains a provision for allowing alternative screen mesh and intake velocity designs for each of the intakes. Any alternative designs proposed must include an entrainment/impingement monitoring strategy designed with input from the DGIF.

- This project is located within 2 miles of a documented occurrence of a state or federal threatened or endangered plant or insect species and/or other Natural Heritage coordination species. Therefore, DGIF recommended coordination with VDCR-DNH regarding the protection of these resources.

Staff requested comments from DCR on July 11, 2014 (see below discussion regarding comments by DCR).
With the City's proposal to incorporate the SFI into its integrated public water supply infrastructure, total authorized system withdrawal has increased and all three of the City's surface water intakes have been incorporated into the proposed permit. Therefore, DEQ coordinated with DGIF regarding this change to the scope of the project on February 2, 2016.

<u>DCR</u>
DCR responded by email dated July 7, 2014, that they did not have any comments regarding the scope of the project.

With the City's proposal to incorporate the SFI into its integrated public water supply infrastructure, total authorized system withdrawal has increased and all three of the City's surface water intakes have been incorporated into the proposed permit. Therefore, DEQ coordinated with DCR regarding this change to the scope of the project on February 2, 2016.

13. Public Involvement during Application Process:

<u>Riparian/Adjacent Landowner Notification and Local Government</u>
Staff notified Rockingham County regarding the reissuance application on July 15, 2014.

Staff notified riparian landowners within one-half mile downstream of the South Fork intake location by letter dated July 15, 2014. No responses were received from either Rockingham County or the four riparian landowners. Notification letters to riparian landowners downstream of the DRI and NRI were not

sent. Staff concluded that notifications were not needed because no project-related impacts are projected at these intake locations. The addition of stream flowby criteria for these previously excluded intakes may actually lessen any existing impacts.

Notifications of riparian and adjacent landowners were conducted in accordance with DEQ's Guidance Memorandum No. 11-2005 (Revised Local Government, Riparian Property Owner, Adjacent Property Owner or Resident, and General Public Notification Procedures for VPDES, VPSA and VWP Permit Applications and Draft Permits).

14. Draft Permit Public Comment Period:

The Public Notice was published in the Harrisonburg Daily News Record on May 28, 2016. The public comment period ran from May 29, 2016 to June 27, 2016.

No public comments were received during the public comment period. Therefore, no changes have been made to the permit conditions.

15. Special Conditions:

The following conditions were developed to protect instream beneficial uses, to ensure compliance with applicable water quality standards, to prevent significant impairment of state waters or fish and wildlife resources, and to provide for no net loss of wetland acreage and function through compensatory mitigation and success monitoring and reporting.

Section A Authorized Activities

No 1 addresses the activity authorized by this permit.
No. 2 states that the authorized activities shall be conducted in accordance with the application materials and any subsequent materials received during the application process.
No. 3 requires the applicant to notify DEQ of any changes to the authorized activities or of new activities which require a VWP permit.

Section B Permit Term

No. 1 addresses the permit term and re-issuance process to ensure that all permit conditions are completed.

Section C Standard Project Conditions

No. 1 addresses the requirement for the minimization of adverse impacts to instream beneficial uses.
No. 2 ensures that the project will be executed in a manner that limits the disruption of the movement of aquatic life.
No. 3 ensures that downstream flows will be maintained to protect both instream and off-stream beneficial uses.
No. 4 prohibits the violation of Water Quality Standards in surface waters as a result of project activities.
Nos. 5 through 9 set forth all reporting requirements concerning as required by the permit and current law and regulations.

Section D Surface Water Withdrawal Conditions

No. 1 restricts surface water withdrawal usage to public water supply.
No. 2 identifies the safe yield of the surface water supply system.
No. 3 states the withdrawal limits for the withdrawal system. The annual limit is based upon calendar year. Tier 1 withdrawal limits are based upon the projected demands for the 15-year permit term. Tier 2 withdrawal limits can be requested by the permittee and approved by DEQ based upon additional demands that occur within the 15 year permit term due to new customers.
No. 4 describes the requirements for authorization of Tier 2 withdrawal limits and states that unless and until Tier 2 limits are approved, the Tier 1 limits are in effect.
Nos. 5 and 6 describe the method for estimating stream flow at the SFI, define net withdrawal and limit net withdrawal from the SFI to no more than 10% of the estimated stream flow. At the request of the applicant, No. 6 includes an example calculation of the maximum net withdrawal allowed for the lowest recorded stream flow at stream gaging station no. 01628500.
Nos. 7 and 8 describe the method for estimating stream flow at the NRI and limit total withdrawals from the NRI to no more than 12% of the estimated stream flow. At the request of the applicant, No. 8 includes an example calculation of the maximum net withdrawal allowed for the lowest recorded stream flow at stream gaging station no. 01622000.

Nos. 9 and 10 require the estimation of flow at the DRI, a minimum flow-by past the intake and require a plan for monitoring flow at the intake.
No. 11 requires the submittal of a plan and schedule within two years of permit issuance for upgrading the existing intake structures at all three intake locations in order to minimize impingement and entrainment of aquatic species. It includes a provision for proposing alternative screen mesh and intake velocity designs. Each proposal must include an entrainment/impingement monitoring strategy developed with input from DGIF and a schedule for implementation of the strategy. Monitoring results must be reviewed by DEQ and DGIF. If the monitoring indicates that the alternative strategy is not protective of aquatic resources, the intakes must be designed with 1 mm screens and an intake velocity of 0.25 fps.
No. 12 requires the permittee to submit a drought management plan to DEQ for review and approval within 120 days of permit issuance. The plan shall include a description of the conservation measures to be implemented during each drought stage.
No. 13 requires conservation measures to protect instream flows during a drought emergency. In this occurrence, the permittee shall implement the most restrictive measures.

Section E Monitoring, Recordation and Reporting Conditions

Nos. 1 and 2 require the daily monitoring and recording of water withdrawal activities at all three intake locations to determine compliance with the withdrawal limitations, and specify daily monitoring requirements.
No. 3 requires the permittee to submit a water withdrawal monitoring report to DEQ semi-annually on the schedule stipulated in the condition. The information shall be submitted electronically using the Virginia Water Withdrawal Reporting System, and in the event the system is not available, via electronic mail. These reporting requirements will also satisfy the annual reporting requirement of 9VAC25-200 et seq.
No. 4 states that the monitoring and reporting activities shall comply with the permit. Any records shall be retained for the life of the permit and potentially longer due to any unresolved litigation.

16. General Conditions:

General Conditions are applied to all VWP individual permits, as stated in the VWP Permit Program regulation.

17. General Standard:

This project may result in minimal, temporary impacts to beneficial uses related to the propagation and growth of aquatic life as defined in the General Standard. Provided the permittee abides by the conditions of the permit, no substances shall enter state waters in concentrations, amounts or combinations that would contravene established standards or interfere with beneficial uses or are inimical or harmful to human, animal, plant, or aquatic life.

18. Staff Findings and Recommendations:

- The proposed activity is consistent with the provisions of the Clean Water Act and State Water Control Law, and will protect beneficial uses.
- The proposed permit addresses avoidance and minimization of surface water impacts to the maximum extent practicable.
- The effect of the impact will not cause or contribute to significant impairment of state waters or fish and wildlife resources.
- The proposed permit conditions address no net loss of wetland acreage and function through compensatory mitigation.
- This permit is proposed to prevent unpermitted impacts.
- The draft permit reflects the required consultation with and full consideration of the written recommendations of VMRC, VDH, DCR and DGIF.

Staff recommends VWP Individual Permit Number 16-0730 be issued as proposed.

Approved:

Director, Office of Water Supply

6/28/16
Date

Appendix A – DEQ Modeling Summary

Introduction

The City of Harrisonburg currently obtains its water supply from two surface water intakes. One is located on the North River near Bridgewater, and the second is located upstream on the Dry River at Rawley Springs (Figure 1). According to the Upper Shenandoah Water Supply Plan (USWSP) dated November, 2011 attached to the Joint Permit Application (JPA), flow to the latter intake is derived from a low-head dam across the Dry River and an underground infiltration gallery. Flow to this intake is also supplemented by releases of water from the Switzer Reservoir a few miles upstream near the headwaters of the Dry River. The North River intake pump station is capable of withdrawing 7.6 million gallons per day (mgd), while the Dry River intake/Switzer Dam combination is currently capable of producing 5.5 mgd. Both of these intakes were previously excluded from the requirements for a Virginia Water Protection (VWP) permit due to their existence prior to July 1, 1989.

The South Fork intake, which was originally permitted under VWP permit 98-1672, is a new intake structure located on the South Fork of the Shenandoah River in Rockingham County, Virginia (Figure 1). Withdrawal from the South Fork intake has not yet begun operation because the pipeline extension project to connect the intake to the City's water system has not yet been completed. The Dry River and North River are both tributaries to the South Fork of the Shenandoah River.

The USWSP and the City's Draft Raw Water System Management Plan (RWSMP, submitted to DEQ on May 5, 2015), indicate that all three intakes will supply water to the City's centralized water treatment plant. The City's raw water optimization strategy, described in the RWSMP, is a plan to fully integrate all three withdrawal sources so that daily raw water supply can be optimized in response to drought and system breakdowns. It is anticipated that this integration will occur during the 15-year permit term. Therefore, all three withdrawal sources were incorporated into the permit evaluation and conditions.

The City's projected system-wide average daily and maximum daily raw water demand volumes for the 15-year permit term (approximately 2031) were determined to be 8.63 mgd and 11.13 mgd, respectively. The RWSMP included withdrawal rates for each intake location for normal and dry years for the City's build-out condition, which would occur after the 15-year permit term based upon the projected one percent per year rate of growth that produced the permit term projections. The raw water optimization strategy proposes a larger proportional usage of the more energy efficient Dry River and North River intakes (relative to the South Fork intake) for normal precipitation years when flows in these tributary streams are normal to above normal. For dry or drought years, the South Fork intake will be relied upon to supply the greatest withdrawals under the assumption that the South Fork of the Shenandoah would have more water available with less downstream impact than the other two streams. The evaluation described below considered the projected 15-year permit term and eventual build-out withdrawal projections, as well as the previous permit condition.

Part I. F.1 of VWP permit 98-1672 stated that the maximum daily withdrawal from the South Fork intake shall not exceed 4.0 mgd, with the following exception: The maximum daily withdrawal from the South Fork intake may increase to 8.0 mgd provided the combined same day withdrawal from the North River and Dry River intakes is less than or equal to 8.0 mgd. Therefore, the system-wide allowable maximum daily withdrawal rate was 16.0 mgd. The permit did not contain conditions limiting the average daily or maximum annual withdrawals.

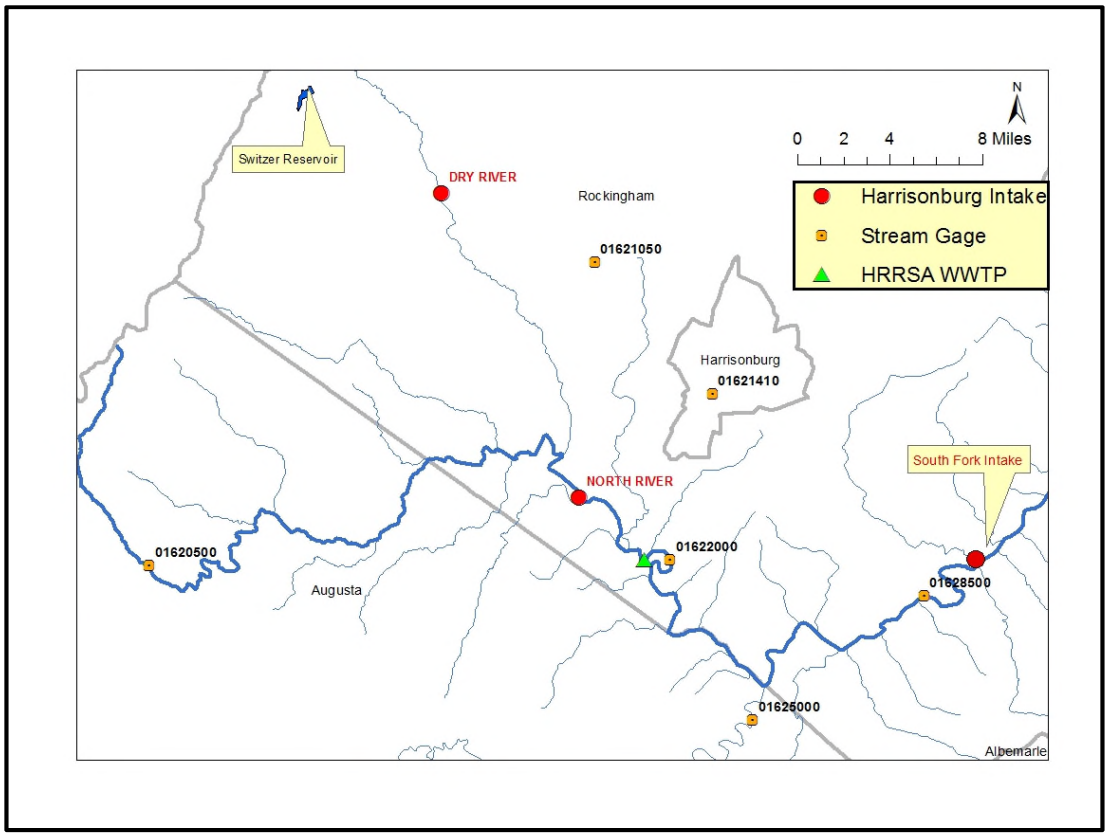

Figure 1. Location of Harrisonburg surface water intakes, nearby stream gaging stations and the Harrisonburg Rockingham Regional Sewer Authority (HRRSA) wastewater plant discharge site

The goal of the modeling analysis was to estimate the potential impacts of proposed water withdrawals from each of the three intakes upon existing beneficial uses, including both in-stream and off-stream uses. The proposed withdrawal rates for each intake were compared to estimated stream flows at each intake location during the drought of record period estimated for the South Fork of the Shenandoah river basin. For the purposes of this analysis, withdrawals at rates less than 10% of the mean daily stream flow were considered optimal for the South Fork and North River intakes. This criterion is based upon consistent recommendations from the Virginia Department of Game and Inland Fisheries (DGIF) to limit withdrawals to no more than 10 percent of instantaneous stream flow in order to avoid a significant loss of habitat for aquatic species. This criterion was not appropriate for the Dry River as this intake location commonly contains no flow during dry periods other than that released from Switzer Dam. The RWSMP states that the City has maintained a 0.5 mgd (0.77 cfs) minimum flow-by at the Dry River intake. This minimum in-stream flow condition was used for the evaluation of the Dry River withdrawals.

Model Inputs

Determination of Drought of Record Period

Gaging Station No. 01628500 (South Fork Shenandoah River near Lynwood) is located approximately 5 miles upstream of the South Fork intake. Gaging station No. 01622000 (North River near Burketown) is located approximately 6.8 miles downstream of the North River intake. The proximity of these gages to these two intakes indicates that their flow records are fairly representative of flow conditions at the gage locations. Examination of daily discharge records spanning an 85-year period of record from these gaging stations indicated that, for the South Fork gage the lowest annual mean and the lowest daily mean flows occurred in 2002. The lowest monthly means for the months of July through September also occurred

during 2002 at this gage. For the Burketown gage, the lowest annual mean and the lowest monthly mean for July occurred during 1999. For each gaging station, the mean monthly flow was less than 50% of the period of record mean monthly flow for 28 months of the 60 month period from 1998 through 2002. Therefore, the multi-year drought period of 1998 through 2002 was determined to be the drought of record for the South Fork basin.

There is no long-term stream flow gaging station located within the Dry River portion of the South Fork basin. However, because the Dry River is a major tributary of the North River and ultimately the South Fork, it was assumed to have the same drought of record period as the rest of the South Fork basin.

Calculation of Temporal Distribution of Withdrawals

Withdrawal rates were distributed by month according to the average of the total monthly withdrawal volumes (Dry River and North Fork intakes) reported by the City of Harrisonburg to the Virginia Water Users Database System (VWUDS) for the 2009-2013 period. The resulting monthly withdrawals were then distributed evenly among each day of each month. Because the reported monthly withdrawals for the 2009-2013 period did not vary significantly from year to year, the assigned monthly percentages did not vary from year to year during the simulations. The monthly temporal distribution informs the simulation as to how to distribute the proposed maximum annual demand over the twelve months of the year.

Estimation of Stream Flow at the Intake Locations

Daily mean stream flow rates at the South Fork intake location were initially estimated by multiplying the daily mean flow rates for 1998 through 2002 reported by gaging station 01628500 by 1.01, which is the ratio of the South Fork intake drainage area (1090 square miles) to that of the gaged drainage area (1079 square miles). Likewise, daily mean stream flow rates at the North River intake location were estimated by multiplying the daily mean flow rates reported by gaging station 01622000 by 0.75, which is the ratio of the North River intake drainage area (461 square miles) to that of the gaged drainage area (615 square miles).

The daily mean flows recorded at both gages for 1998 through 2002 were influenced by Harrisonburg's North River and Dry River withdrawals, which occur upstream of both gages. Flows recorded by the both the South Fork station (01628500) and the North River station (01622000) are also affected by the discharge from the HRRSA wastewater plant (Figure 1), which processes much of the water withdrawn by the City from the two existing intakes. Therefore, the initial estimates of flow at the South Fork and North River intakes were adjusted to account for the changes in the City's upstream withdrawals and wastewater discharges. For each dry-year withdrawal scenario discussed below, flow estimates at the South Fork intake were first increased by an amount equal to the projected change (decrease) in upstream Harrisonburg withdrawals (North River + Dry River), relative to the reported 1998-2002 (drought of record) monthly withdrawals. The South Fork and North River flow estimates were also increased by an amount equal to the estimated increase in wastewater discharge from the HRRSA plant. The reported monthly wastewater discharge rates for 1998-2002 could not be used to determine the increase because they are believed to include an unknown percentage of stormwater discharge. Therefore, a constant percentage of the increase in the City's total surface water withdrawal was assumed to be discharged as wastewater. The City provided information in the JPA that 82% of the projected build-out withdrawal rates would supply sewered areas. A 20% consumptive use rate was assumed to occur within these areas. Therefore, 66% (80% of the JPA's noted 82%) of the increase in total system-wide withdrawals was assumed to be discharged and the mean daily flows at the South Fork and North River intakes were increased by that amount.

The VaHydro operational model was used to estimate stream flow at the Dry River intake location. These simulations also incorporated flow released from Lake Switzer into the Dry River upstream of the intake. According to the RWSMP, the main gate controlling releases is kept partially open. Consequently, the release rate can vary from 8 mgd when the reservoir is full to zero gallons when the water level drops to the elevation of the release gate. The releases from Switzer Dam were simulated using the VaHydro operational model with stage-storage and release rules provided in the RWSMP for Switzer Reservoir. With a linearly decreasing rate of release as water level declines from full pool (1600 mg, or 2273 ft NGVD) to the elevation of the main release gate (2234 ft NGVD), the simulated reservoir storage remained above the unusable storage level of 400 mg. A second simulation that assumed a 10% loss of reservoir storage since the stage-storage data were first reported also indicated that usable storage would not be completely depleted during the drought of record and that releases would be maintained (Figure 2). During drought years when the natural stream flow in the Dry River is very low or even zero, it is reasonable to expect that a significant portion of water released from Switzer Reservoir infiltrates to the groundwater flow system beneath the bed of the Dry River and does not reach the City's intake location as surface water. It was assumed that two-thirds of the water released from Switzer Dam flows to the Dry River intake during drought years. Therefore, the daily release rates were multiplied by 0.67, before being added to the estimated stream flow for subsequent simulations in which flow at the Dry River intake was estimated. For these simulations, the drainage area of Switzer Reservoir was subtracted from the Dry River intake drainage area to avoid double-counting of stream flow from the reservoir area.

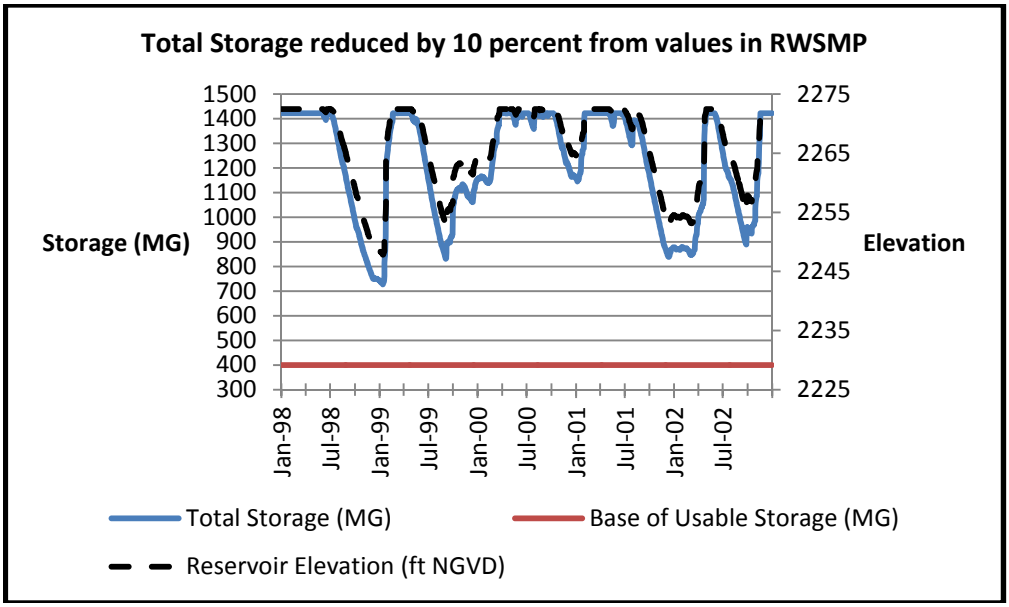

Figure 2: Simulated storage and water level elevation, Switzer Reservoir (MG = million gallons)

Withdrawal Comparisons

The adjusted daily stream flow rates at each of the City's intake locations were compared to a series of projected withdrawal rates for each intake. The objective was to determine the optimal combination of withdrawal rates to minimize instances in which withdrawals would exceed 10% of estimated streamflow during the drought of record. The withdrawal rates that were compared included: 1) the previous permit condition, 2) a dry year build-out scenario with a withdrawal distribution between the three sources based upon the RWSMP drought management scheme (labeled "Projected Build-out"), and 3) a series of

alternate withdrawal distributions for both a dry year build-out scenario and for the 15-year permit term. Table 1 lists the average daily and maximum daily withdrawal rates for each intake for the two former scenarios, plus an alternate withdrawal distribution for build-out and a proposed distribution for the permit term. The maximum daily values for the permit term distribution were derived using the same peak to average ratio used for the RWSMP projections.

Table 1: City of Harrisonburg withdrawal scenarios:

Scenario	Average Daily Withdrawal (mgd)				Maximum Daily Withdrawal (mgd)				
	Dry	North	SF	Total	Dry	North	SF	Dry+ North	Total
Previous Permit Condition	-	-	-	-	-	-	8.00	8.00	16.00
Projected Build-out (Dry Year):	1.37	4.37	6.14	11.88	1.77	5.64	7.92	-	15.33
Alternate Build-out (Dry Year)	2.00	2.50	7.38	11.88	2.58	3.23	9.52	-	15.33
Proposed Permit Term (Dry Year)	1.37	1.76	5.50	8.63	1.77	2.27	7.09		11.13

Previous Permit Condition:

The previous permit condition included only maximum daily limits on the South Fork (8 mgd) and on the sum of North and Dry River withdrawals (8 mgd). Assuming that withdrawals of 8 mgd occurred at the South Fork intake on a daily basis throughout 1998-2002, withdrawals exceeded 10% of adjusted streamflow for a week or more during summer 2002 conditions (Table 3). Exceedances were reduced somewhat when the withdrawal rate was reduced by 10% to account for conservation. A conservation reduction of 10% was assumed because the summer of 2002 generally represented emergency drought conditions when mandatory water conservation measures would take effect. Mandatory conservation measures generally result in water use reductions of 10% to 15%. This particular comparison, however, does not address the number of potential exceedances of the 10% criterion at the North or Dry River intakes with this permit condition because it did not specify withdrawal volumes or in-stream flow criteria for those locations.

Table 3: Number of days that withdrawal of 8 mgd at the South Fork intake would exceed 10% of adjusted streamflow under the previous permit condition (10% conservation: withdrawal rate reduced by 10%)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
No Conservation:													
1998	0	0	0	0	0	0	0	0	0	0	0	0	**0**
1999	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2000	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2001	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2002	0	0	0	0	0	0	**9**	**13**	**19**	0	0	0	**41**
10% Conservation:													
1998	0	0	0	0	0	0	0	0	0	0	0	0	**0**
1999	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2000	0	0	0	0	0	0	0	0	0	0	0	0	**0**

2001	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2002	0	0	0	0	0	0	7	9	9	0	0	0	**25**

Projected Build-out Conditions:

The City's RWSMP listed build-out dry-year average and maximum withdrawal rates for each intake (Table 1). Tables 4 – 6 display the criterion exceedances for each intake that resulted from simulations comparing the withdrawal rates to the corresponding adjusted stream flow rates.

Table 4: Number of days that a flow-by of 0.5 mgd would not be maintained at Dry River: average withdrawal = 1.37 mgd (no conservation).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1998	0	0	0	0	0	0	0	0	0	0	0	5	**5**
1999	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2000	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2001	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2002	0	0	0	0	0	0	0	0	0	0	0	0	**0**

Table 5: Number of days during which withdrawal would exceed 10% of adjusted streamflow at the North River intake; withdrawal = 4.37 mgd:

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
No Conservation:													
1998	0	0	0	0	0	0	1	12	29	29	30	26	**127**
1999	7	0	0	0	0	20	31	31	5	0	0	0	**94**
2000	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2001	0	0	0	0	0	0	5	3	27	31	30	30	**126**
2002	31	28	15	0	0	3	30	29	28	14	0	0	**178**
10% Conservation:													
1998	0	0	0	0	0	0	0	3	23	20	27	14	**87**
1999	5	0	0	0	0	13	31	29	5	0	0	0	**93**
2000	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2001	0	0	0	0	0	0	0	0	27	31	30	26	**114**
2002	31	28	8	0	0	0	25	27	27	6	0	0	**152**

Table 6: Number of days during which withdrawal would exceed 10% of adjusted streamflow at the South Fork intake; withdrawal = 6.14 mgd:

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
No Conservation:													
1998	0	0	0	0	0	0	0	0	0	0	0	0	**0**
1999	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2000	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2001	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2002	0	0	0	0	0	0	5	6	3	0	0	0	**14**
10% Conservation:													
1998	0	0	0	0	0	0	0	0	0	0	0	0	**0**
1999	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2000	0	0	0	0	0	0	0	0	0	0	0	0	**0**

2001	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2002	0	0	0	0	0	0	0	0	0	0	0	0	**0**

Average withdrawals of 0.77 mgd at Dry River maintained the required flow-by throughout the drought of record without reducing the withdrawal due to conservation. However, the adjusted flow rate in the North River is not high enough to sustain an average drought-year withdrawal rate of 4.37 mgd. At the South Fork intake, exceedances of the 10% criterion were minimal at an average withdrawal rate of 6.14 mgd, and were eliminated with a 10% decrease in withdrawal due to conservation measures.

Based on these results, additional simulations were run with alternative build-out drought-year withdrawal configurations among the three intake locations. The objective of these simulations was to find an alternative distribution of drought-year average withdrawal rates among the three intakes with which exceedances of in-stream flow criteria would be minimized. Withdrawal rates at Dry River and South Fork were increased, while those at North River were decreased from the rates presented in the RWSMP. Tables 7 – 9 list the exceedances that resulted from one alternative distribution (listed as "Alternate Build-out (Dry-Year)" in Table 1). At South Fork, a 10% conservation reduction in withdrawals reduced the number of exceedances significantly. At the North River intake, 10% conservation also reduced the number of exceedances and a relaxation of the criterion to no more than 12% of flow eliminated them. At Dry River, the simulated natural stream flow was zero during November and December of 1998 and the rapid drop in the level of Switzer Reservoir reduced the flow rate of releases to the point where, for several days there was insufficient flow at the downstream intake to maintain the 0.5 mgd flow-by and still withdraw at a rate of 1.80 mgd.

The daily withdrawal rates in the simulations described above were based upon the average fluctuation in reported monthly withdrawal totals from 2009-2013. The maximum daily withdrawal rates calculated using this method are lower than those listed in Table 1, and therefore they only approximate the number of days during which the withdrawals from each intake could exceed the in-stream flow criteria. The simulation results were further examined to determine the system-wide maximum daily withdrawal rate that could meet the instream flow criteria at each intake throughout the drought of record.

The HRRSA wastewater discharge is located downstream of the Dry River and North River withdrawals, but upstream of the South Fork intake. Therefore, because a significant portion of the amount pumped from the river at the South Fork intake is returned upstream, net withdrawal from this intake was compared to the in-stream flow criterion rather than the total withdrawal. The net withdrawal equals the total volume withdrawn minus the estimated fraction of that volume that is returned upstream via the treated wastewater discharge. When net withdrawal was compared to river flow, the in-stream flow criterion of 10% would be met throughout all but three days of the driest period on record (July – September of 2002), using the build-out maximum daily total withdrawal at South Fork of 9.52 mgd listed in Table 1. The comparison assumed a 10% reduction in the projected maximum daily withdrawal rate due to conservation measures. Therefore it is anticipated that the City's drought response plan would be implemented during such an extreme drought period.

The minimum recorded flow at gage 01628500 on the South Fork was 84 cfs on July 8, 2002, which equals an estimated minimum flow at the South Fork intake location of 84.8 cfs (54.8 mgd). Therefore, the maximum net withdrawal rate that would meet the 10% criterion at this minimum flow is 5.48 mgd. At the assumed average percent return flow (66%), this net withdrawal approximately corresponds to a total withdrawal from the South Fork of 9.1 mgd. The maximum total withdrawal from the North River

intake that would not exceed 12% of estimated river flow on any day during the same July- September 2002 driest period is 2.53 mgd. The simulation conducted to produce Table 7 also indicated that the 0.5 mgd flowby at the Dry River intake would be met throughout the same period with a maximum daily withdrawal of 2.44 mgd. Therefore, a combined, system-wide maximum daily total withdrawal of 14.07 mgd (9.1 + 2.53 + 2.44) could be maintained during the drought of record while meeting each location's instream flow criterion. This volume exceeds the proposed system-wide maximum daily withdrawal rate (15.33 mgd) reduced by 10 percent when emergency conservation measures are employed (15.33-1.53 = 13.80 mgd).

There is a significant amount of uncertainty in these simulations. For example, the percentage of flow released from Switzer Reservoir that reaches the Dry River intake was estimated to be two-thirds. The actual percentage of the release reaching the intake is probably highly variable and dependent upon antecedent moisture conditions. Nevertheless, based on these simulations the projected build-out average daily withdrawal rate of 11.28 mgd could be maintained during a drought of record year as long as there is flexibility in the water withdrawal system to shift withdrawals between the intakes, depending upon stream flow conditions. Allowing a larger percentage of flow (12%) to be withdrawn at the North River intake may be justified by the fact that much of the water withdrawn (approximately two-thirds) is returned to the river approximately 5 river miles downstream of the intake at the HRRSA wastewater plant (Figure 1).

Table 7: Number of days that a flow-by of 0.5 mgd would not be maintained at Dry River: average withdrawal = 2.00 mgd.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
No Conservation:													
1998	0	0	0	0	0	0	0	0	0	0	11	9	**20**
1999	0	0	0	0	0	0	0	0	0	0	1	3	**0**
2000	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2001	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2002	0	0	0	0	0	0	0	0	0	0	0	0	**0**
10% Conservation:													
1998	0	0	0	0	0	0	0	0	0	0	11	9	**15**
1999	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2000	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2001	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2002	0	0	0	0	0	0	0	0	0	0	0	0	**0**

Table 8: Number of days during which withdrawal would exceed in-stream flow criteria at the North River intake; withdrawal = 2.50 mgd:

Number of days that withdrawal exceeds 10% of flow at intake:													
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
No Conservation:													
1998	0	0	0	0	0	0	0	0	0	0	0	0	**0**
1999	0	0	0	0	0	0	**11**	**18**	2	0	0	0	**16**
2000	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2001	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2002	0	0	0	0	0	0	**4**	**8**	**23**	0	0	0	**25**
Number of days that withdrawal exceeds 10% of flow at intake:													
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
10% Conservation:													
1998	0	0	0	0	0	0	0	0	0	0	0	0	**0**
1999	0	0	0	0	0	0	**7**	8	0	0	0	0	**1**
2000	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2001	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2002	0	0	0	0	0	0	**2**	4	**18**	0	0	0	**5**
Number of days that withdrawal exceeds 12% of flow at intake:													
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
10% Conservation:													
1998	0	0	0	0	0	0	0	0	0	0	0	0	**0**
1999	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2000	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2001	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2002	0	0	0	0	0	0	0	0	0	0	0	0	**0**

Table 9: Number of days during which withdrawal would exceed 10% of adjusted streamflow at the South Fork intake; withdrawal = 7.38 mgd:

Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
No Conservation:													
1998	0	0	0	0	0	0	0	0	0	0	0	0	**0**
1999	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2000	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2001	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2002	0	0	0	0	0	0	**9**	**14**	**19**	0	0	0	**36**
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
10% Conservation:													
1998	0	0	0	0	0	0	0	0	0	0	0	0	**0**
1999	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2000	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2001	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2002	0	0	0	0	0	0	**7**	**9**	**10**	0	0	0	**13**

Permit Term:
Comparisons were also made using a dry-year withdrawal distribution derived from the average daily demand justified for the 15-year permit term (Table 1). The numbers of stream-flow criteria exceedances per month are listed in Tables 10-12. The simulated exceedances of the in-stream flow criteria were minimal at the Dry River and zero at the North River and South Fork intakes.

Table 10: Number of days that a flow-by of 0.5 mgd would not be maintained at Dry River: average withdrawal = 1.37 mgd.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
No Conservation:													
1998	0	0	0	0	0	0	0	0	0	0	0	5	**5**
1999	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2000	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2001	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2002	0	0	0	0	0	0	0	0	0	0	0	0	**0**
10% Conservation:													
1998	0	0	0	0	0	0	0	0	0	0	0	0	**0**
1999	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2000	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2001	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2002	0	0	0	0	0	0	0	0	0	0	0	0	**0**

Table 11: North River Intake at projected permit term withdrawal of 1.76 mgd:

Number of days that withdrawal exceeds 10% of flow at intake:

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
No Conservation:													
1998	0	0	0	0	0	0	0	0	0	0	0	0	**0**
1999	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2000	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2001	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2002	0	0	0	0	0	0	0	0	0	0	0	0	**0**
10% Conservation:													
1998	0	0	0	0	0	0	0	0	0	0	0	0	**0**
1999	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2000	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2001	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2002	0	0	0	0	0	0	0	0	0	0	0	0	**0**

Table 11 (continued): Number of days that withdrawal exceeds 12% of flow at intake:

10% Conservation:													
1998	0	0	0	0	0	0	0	0	0	0	0	0	**0**
1999	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2000	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2001	0	0	0	0	0	0	0	0	0	0	0	0	**0**

2002	0	0	0	0	0	0	0	0	0	0	0	0	**0**

Table 12: Number of days during which withdrawal would exceed 10% of adjusted streamflow at the South Fork intake; withdrawal = 5.44 mgd:

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
No Conservation:													
1998	0	0	0	0	0	0	0	0	0	0	0	0	**0**
1999	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2000	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2001	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2002	0	0	0	0	0	0	0	0	0	0	0	0	**0**

Determination of Safe Yield

The safe yield of a surface water withdrawal project is the maximum volume of water that can be withdrawn on an average daily basis during the drought of record (for the area in which the withdrawal is located) to meet the needs of the project while still protecting the other beneficial uses of the waterbody. The safe yield value is subject to change if the drought of record changes or if the operating rules and/or in-stream flow criteria that governed the determination of the safe yield value change.

The simulations described above indicated that total system-wide withdrawals less than or equal to the projected build-out rate of 11.88 mgd will probably allow for daily adjustment of the withdrawal rates at the three intakes so that the following in-stream flow criteria can be met:

- South Fork: withdrawal no greater than 10% of flow at the intake location
- North River: withdrawal at no greater than 12% of flow at the intake location
- Dry River: minimum flow-by of 0.5 mgd

Total system-wide withdrawals greater than those projected for Harrisonburg's build-out condition may result in situations wherein withdrawals at individual intakes cannot be adjusted to meet these in-stream flow criteria. Therefore, the projected build-out average-day system-wide withdrawal rate of 11.88 mgd can be considered the safe yield of the Harrisonburg water withdrawal system. This safe yield value includes the condition that all three intakes have been combined into a single network in which daily withdrawals from the individual intakes can fluctuate depending upon local conditions.

This safe yield value is subject to change if a new drought of record occurs, or if changes to withdrawal limitations in the permit are considered to protect beneficial uses. It should be noted that this value does not represent the total volume of water present at the City's intakes during the drought of record.

Conclusion

Based on results of the modeling analysis conducted for the proposed project, the safe yield of the proposed combined water withdrawal system is 11.88 mgd. The proposed withdrawal rates will provide a reasonable margin of safety for protection of beneficial uses, provided that: 1) the system is sufficiently connected to maximize flexibility in operation so that withdrawal sources can be shifted in response to stream flow conditions, 2) conservation measures during severe drought conditions reduce maximum daily demands by 10 percent, and 3) Switzer Reservoir water releases and water levels are controlled in order to maximize the availability of water for the Dry River intake. The evaluation represented the worst-case climatic conditions observed in the historic record. Therefore, potential impacts to beneficial uses should be avoided during the permit term by implementing the above measures.