EASTERN VIRGINIA GROUNDWATER MANAGEMENT ADVISORY COMMITTEE

WORK GROUP #2B – TRADING

MEETING NOTES – MEETING #5 - FINAL

FRIDAY, MAY 20, 2016

1:00 A.M. – 4:00 P.M.

DEQ PIEDMONT REGIONAL OFFICE – TRAINING ROOM

Meeting Attendees

EVGMAC – WORKGROUP #2B	
Terry Blankenship – Aqua Virginia	Chris Pomeroy – Western Tidewater Water Authority/AquaLaw
Jamie Mitchell – Hampton Roads Sanitation District	Don Rice – City of Newport News
Eric Gregory – King George County	Kurt Stephenson – Virginia Tech
Lewie Lawrence – Middle Peninsula PDC	Wilmer Stoneman – Virginia Farm Bureau
Britt McMillan – ARCADIS – Eastern Shore Groundwater Committee	Shannon Varner – Troutman Sanders/Mission H2O

EVGMAC – WORKGROUP #2B – STATE AGENCIES	
Susan Douglas – VDH-ODW	Dwayne Roadcap – VDH-OEHS
Scott Kudlas – DEQ – Central Office	

NOTE: Workgroup Members NOT in attendance: Jeff Gregson – VA Well Drillers Association; Sandi McNinch – VA Economic Development Partnership

INTERESTED PARTIES ATTENDING MEETING	
Ken Bannister- Draper Aden Associates	Rhea Hale - WestRock
Robert Crockett - Advantus	Barrett Hardiman – Luck Companies
Chris Gill – Christian & Barton	Matt Wells - WestRock

SUPPORT STAFF ATTENDING MEETING	
Brandon Bull - DEQ	Mark Rubin – VA Center for Consensus Building
Craig Nicol - DEQ	Jutta Schneider - DEQ
Bill Norris - DEQ	

1. Welcome/Introductions (Mark Rubin – Meeting Facilitator)

Mark Rubin, Executive Director of the Virginia Center for Consensus Building at VCU, opened the meeting and welcomed everyone and asked for introductions.

2. **Review of Agenda; General Sense of the Process and Introductory Comments (Mark Rubin):**

Mark Rubin reviewed the agenda for the meeting and the plan for conducting the meeting. He noted that there will be a meeting of the main advisory group on Friday, June 24th from 9:00 – 12:30. The current plan is to present the work products from each of the Workgroups to the EVGMAC members for their consideration.

For this workgroup (#2B – Trading) we had talked about putting together a "Strawman" on how to incentivize banking that we could use as the work product from this group. So, the plan for today's meeting is to spend our time reviewing and putting the finishing touches on that document.

3. **Workgroup Updates (Mark Rubin):**

Mark provided a brief update on the activities of the other EVGMAC Workgroups. He noted the following:

- In the Alternative Sources of Supply Workgroup (Workgroup #1) the decision was made to divide the management area into regions to evaluate the alternatives - these included: the "Fall-Line"; "Central"; and "Eastern". They went through their "regions" and identified a number of alternative supplies for each of the regions. They looked at the beginnings of funding options for each of those alternatives. They looked at impediments for proceeding with those alternatives and they looked at nonfinancial incentives. They developed a "matrix" with that information that is in the process of being finalized. The "matrix" was fairly well fleshed out at the last meeting and that document has been distributed to them for additional review and editing and comments. Hopefully, we will end up with a matrix that we can present to the committee. Mark noted that no one has been asked to approve this as a final product, it is being presented to the main committee as information for them to give us some guidance as to whether this is the track that they want us to be on; are these the concerns that we ought to be addressing or are their other concerns that we ought to be taking into consideration?
- In the Alternative Management Structures Workgroup (Workgroup #2A) we have talked about all sorts of different structures that might be used. The notion came back that the permitting system works fairly well when there is plenty of water – the issues come when there is not enough water. The workgroup has come up with a proposal to take the "Surface Water Management Act" which has a provision in it that allows for "Voluntary Allocation Agreements" for folks that have "rights" to water. The question that they are looking at is "Could Voluntary Allocation Agreements be used as a means of getting through a tough time when there is not sufficient water available? There is a draft that has been developed by Andrea Wortzel to utilize those types of agreements within the groundwater management area. That draft is currently being reviewed that will be sent back out to the group for consideration at a meeting on Monday, June 13th (1:00 – 4:00) prior to being presented to the main advisory committee on June 24th. Within that document is a notion of a "trading piece" in it. The "trading

piece" is not through a market but would be trading that would take place among the 3 or 4 users that would be party to the agreement but it would not be an open trading program.

- Essentially both of the workgroups are trying to narrow and focus their work so that we have viable work products to present to the Advisory Committee at their meeting on June 24th.

4. Discussion – Strawman (Kurt Stephenson)

Kurt Stephenson reviewed the documents that were distributed to the group related to "Aquifer Storage and Recovery Programs". A copy of the "strawman" was distributed to the group. In addition a summary document and a figure with "available storage credits" were also distributed. Kurt noted that between the last meeting of the group and this meeting information was gathered related to what other states and regions are doing with respect to "Aquifer Storage and Recovery". He reviewed the "summary" document with the group.

Summary of Aquifer Storage and Recovery Programs

Program/Project	Crediting Rate (limits on recovery of stored water)	Credit Time Conditions (Duration)	Spatial Recovery Limits	Water Credit Transfer	Aquifer condition
Arizona Water Banking: Long Term Storage Credits	Deduct 5% "cut to the aquifer" Deduct 3-5% for delivery losses (evaporation, overflow, outflow, etc.).	No credit time limit, but rate of withdrawal is regulated by ADWR (ADWR formula for determining each year how much water is available for recovery)	Zonal (predefined area): Recovery must be within the storage area (Active Management Areas, or AMAs)	Yes (within GW Management Areas)	Unconfined Aquifer
Southern Nevada Groundwater Bank	Deduct small percentage at the time of initial injection	No time limit. Max rate of withdrawal of 20,000 AFY	Las Vegas Valley groundwater basin	Yes (within GW basin)	Confined
Other long term Nevada groundwater banks	GW recharge credited in GW storage account: X% of credits deducted annually for storage losses	All stored credits lost after 10 years.	Within same GW basin, subject to permit conditions	Yes (within GW basin)	Varied

	(the amount depends on modelled loss estimates). Loss rate may change (decrease) over time based on new info (model results)				
Other short term Nevada Groundwater banking	1:1 (or nearly so)	1 season	Generally same location	None	Varied
New Jersey ASR	1:1 banking on three year rolling average	3 Water years	None. The category does not typically apply to conventional ASR facilities employing dual purpose well	Permit specific	Confined
Delaware ASR	1:1	1 season unless, a utility petitions for water banking	None. The category does not typically apply to conventional ASR facilities employing dual purpose well	None	Confined
Florida ASR	1:1*	Multiple seasons, but, permit specific (used for seasonal water supply management)	None. The category does not typically apply to conventional ASR facilities employing dual purpose well	None	Confined
Kansas	1:1	1 season unless, a utility petitions for water banking	None. The category does not typically apply to conventional ASR facilities employing dual purpose well	None	Confined

North Carolina (planned/experimental ASR projects Cape Fear, Greenville)	1:1	No official policy, but proposals are for seasonal storage	Same location	N/A	Confined

* In Florida, permittees do not typically withdrawal 1:1. Florida ASR project are injecting into brackish aquifer systems, but permittees only wish to recover the injected freshwater. Recovery rates range from 20-40% following the initial years of ASR operation and increase to 70 to 90% as ASR systems mature and freshwater is built up in the aquifer.

Sources:

Arizona:

http://www.azwater.gov/azdwr/WaterManagement/Recharge/RechargeCreditsandAccounting.htm
http://www.azleg.state.az.us/ars/45/00852-01.htm
http://www.azwaterbank.gov/Water_Storage/Recharge_and_Facilities.htm#Facilities
http://www.azwaterbank.gov/Plans_and_Reports_Documents/documents/Joint_RecoveryPlan04-14-14withsignedpreface.pdf

Nevada

https://www.snwa.com/ws/future_banking.html
http://water.nv.gov/hearings/past/spring/browseable%5Cexhibits%5CSNWA/511.pdf
https://www.snwa.com/assets/pdf/wr_plan_chapter3.pdf
Personal communication (K. Stephenson) with Adam Sullivan, Nevada Division of Water Resources, April 19th, 2016

New Jersey, Delaware, Florida, Kansas

Personal communication, Daniel Holloway, CH2M, April 2016.
Personal communication (B. Bull) with Joe Haberfeld, Florida Department of Environmental Protection (DEP) and Bob Verrastro, South Florida Water Management District, April 2016.

North Carolina

Personal communication (K. Stephenson), Nat Wilson, North Carolina DEQ May 25, 2016.

He noted the following:

- There are two types of ASR programs:
  - "Long-Term" – Where you want to or need to store water over multiple years, &
  - "Short-Term" - Where you are using the aquifer for seasonal "smoothing" of water – you pump into the aquifer when you have a surplus then you withdraw the water from the aquifer within the first year or two to provide for summer peak usage and to smooth out the water usage across a season.
- The example of the "Southern Nevada Groundwater Bank" is a program that has been grandfathered in – it deducts a small percentage at the time of initial injection and has no time limit – with a max rate of withdrawal of 20,000 AFY – the folks contacted in Nevada indicated that they would not use this approach in the future.

- In Nevada, you can withdraw water anywhere within the same basin that you inject. Their aquifers are fairly uniform – the aquifers are small and well defined.
- The information from the Eastern part of the Country were compiled with the assistance of Daniel Holloway from CH2M and Brandon Bull from DEQ.
- The examples provided in the East tend to be more of a seasonal approach where you are addressing water needs for 1 to 3 seasons. Usually, you can withdraw what you inject into the aquifer. It is a dual purpose well that is being used for both injection and withdrawal at the same point. There are no real spatial issues that have to be addressed. In these examples that are really not any "trading" issues or components that needs to be addressed.

The Workgroup's discussions included the following:

- In the example in the summary sheet of the Nevada Groundwater Banks is the 10 year limit a rolling 10 year or an absolute "10-year" period? *It is from when you inject the water – so it is a rolling "10-year" period.*
- Why is the "Southern Nevada" approach not being used beyond the grandfathered bank? *They indicated that they now have a better understanding of the groundwater system and they now have a groundwater modeling tool that they can use to better estimate loses. They have greater confidence in the modeling tool than the "estimation tool" that they were originally using.*

Kurt noted that the strawman is based on the Nevada Model in that you get a storage credit when you inject water and then there will be some sort of process to address/estimate annual loss rates and those loss rates will be deducted from whatever remaining credits that you have left over on an annual basis. This example is divided into both "seasonal" and "long-term" storage options. Under the "seasonal" storage approach there would be an expedited permitting process – you can withdraw what you inject on a "1 to 1" basis and the permit would expire at the end of the year – using a dual purpose well. Examples are provided as to how a "long term storage" process would work. You would need to have a recovery factor that would be determined by DEQ based on where you are in the aquifer and the characteristics of the aquifer and what the loss rates in that area are.

Groundwater Banking (ASR) Strawman

Definitions

Injected water: total annual quantity of water injected into the confined aquifer in the eastern Virginia and Eastern Shore Groundwater Management Areas.

Groundwater storage credit: the total quantity of injected water that can be recovered from the aquifer. Credits available for use in a given year is equal to the remaining injected water at the end of the previous year multiplied by the recovery factor. Credits are deposited into the permittee's groundwater storage account at DEQ and retired when injected water is recovered and as water is lost to the system.

Recovery factor: the annual fraction of the remaining injected water that is available for recovery by the permittee. The recovery factor is calculated as one minus the annual water loss rate (rate at which injected water is lost for recovery).

GW storage account: VDEQ will maintain and publish annually a groundwater storage account for any permittee holding groundwater storage credits.

Recovery zone: the spatial boundary from which injected water may be recovered.

Seasonal storage: projects recover injected water within the same water year.

Long term storage: injection projects that may withdraw water across multiple years. The aquifer is used for long term temporary storage.

Groundwater Credit

Within existing groundwater management areas, DEQ will grant a *groundwater credit* to any party that injects water into the confined coastal aquifer for purposes of using the aquifer for temporary water storage and recovery.

A groundwater credit is considered additional to a groundwater allocation granted under a groundwater withdrawal permit. Groundwater allocations shall not be reduced based on injection activity of the permittee.

A well injection permit would be required before any water is injected into the Virginia aquifers.

Seasonal Storage

Recovery factor for seasonal storage shall be 1. (1:1 inject to recovery rate)

Credit duration: 1 year. Credits not used within the year of being injected will be retired.

Spatial Recovery: Recovery occurs at the same facility as injection.

Credit transfer between permittees: None

Long Term Storage

Recovery factor: Recovery factors will be based on estimated *annual aquifer losses* using the groundwater model. Guidelines for estimating aquifer losses will be published and updated by VDEQ. For projects injecting into the Potomac coastal plain aquifer, the recovery factor shall not be less than 0.95

A recovery factor schedule covering 10 years will be established by VDEQ. Once established, the schedule shall not be modified downward.

VDEQ may establish maximum annual limits on the rate of withdrawal from recovery wells.

Credit duration: Credits have 10 year useful life. All credits remaining after 10 years will be permanently retired.

Spatial Recovery: Recovery can occur off-site of the injection location. The spatial recovery zone will be delineated during the permitting process. DEQ will develop guidelines for defining the spatial recovery zone. The spatial recovery zone will define to the maximum extent practicable and subject to reasonable expectations that no adverse impacts will be imposed on third party users.

Credit transfer between permittees: Groundwater storage credits may be transferred to another party within the spatial recovery zone.

The Workgroup's Discussion regarding "definitions" included the following:

- *"Injected water*: total annual quantity of water injected into the confined aquifer in the eastern Virginia and Eastern Shore Groundwater Management Areas."
    - Do we want to limit it to just "confined"? It is a little more flexible if you remove the term "confined". Could probably be addressed either way. There is probably not much need or demand to deal with the unconfined aquifer.
    - Would need to look at different "recovery factors" between the confined and unconfined aquifer.
    - Could stormwater be injected into the unconfined aquifer as a BMP strategy? That is typically what a stormwater pond does. The question is really are you going to want to reuse the water. The only reason to take this credit would be if you want to use the water later on and the only place that you could reuse it later on would be in the water table system – so are you going to want to reuse it in the water table system? There may be some folks that want to do it.
    - How many permitted users in the water management area are getting their permit to withdraw water from the surficial aquifer? There are probably a dozen or two dozen – there may be more on the Eastern Shore.
    - A lot of irrigation is going to the unconfined aquifer.
    - Consensus of the group was to remove the term "confined".
    - Is there a definition of "water"? In this definition, what is the "quantity of water injected"? What is the source of that water? What is the quality of that water? The quality of water would be governed by any injection permit. You could use the phrase:

"any injected water as long it is of potable quality". The UIC and the "anti-degradation" policy would dictate quality.
    - Under other trading concepts it becomes very difficult and confusing when you mix regulatory quality standards with the basic mechanics of the trading program. Whatever the regulatory quality requirements are – they are what they are.
    - Why is there a time element in the definition? Why does it say "total annual" couldn't it just refer to the total amount of injected water? This concept is looking at a 10 year period so it is appropriate to look at an annual amount unless we want to get away from using a 10-year time period. The time period could be addressed elsewhere. If so then the definition could be just "total quantity of water injected into an aquifer in the eastern Virginia and Eastern Shore Groundwater Management Area".
    - Why not also remove the phrase "total quantity" and just address "water injected…)?
    - Why not just say: "…into a Groundwater Management Area…"? This might not be appropriate since the remainder of the state is going to be fractured rock or alluvial basin and this might not be the approach that will need to be taken in those areas. A different approach may be needed in those areas. The reference to the two areas should be retained.
    - What do we mean by "injected"? Maybe it should read: "mechanically introduced into the aquifer"? Would have to be covered by a UIC permit. Do we want to say "water mechanically injected"? Let's not add complexity for complexity's sake – let's deal with exceptions in a different way rather than with a broad brush approach.

- *Groundwater storage credit:* the total quantity of injected water that can be recovered from the aquifer. Credits available for use in a given year is equal to the remaining injected water at the end of the previous year multiplied by the recovery factor. Credits are deposited into the permittee's groundwater storage account at DEQ and retired when injected water is recovered and as water is lost to the system.
    - In the first sentence the word "can" is used. Is it the physical ability to do this or is this a regulatory permission to do this? Should this be an "authorization" to do this? The preconceived notion of this was that it was related to a regulatory authorization. In some instances it may represent a real limitation but in other cases it doesn't. It is a regulatory concept.
    - The credit is what you are "allowed" to withdraw rather than what you "can" withdraw.
    - The withdrawal permit sets the limits on the amount of water that you are "authorized" to withdraw.
    - You would get your account (number of credits) for a given period of time and if somebody from within that area of impact need to get the water and they got authorization from the individual holding the credits to use a certain number or amount of credits that would somehow be documented that they had authorization to do it and the limitation on how they would do it would be in their withdrawal permit.

- In the case of a third party (the purchaser of the credit) is assigned a monthly maximum of a million gallons a month – so they can only pump a million gallons a month – that is based on their demand plus the impacts – now they buy a credit – they buy a ½ million gallons a month credit from somebody – that is not necessarily additive to their existing 1 million gallons a month authorization – how do you work out the monthly maximum from that standpoint? Because if someone is at the edge of the area they may not be able to pump 1 and ½ million gallons a month without impacts to the aquifer. This is the piece that is unresolved. It is uncertain at this stage of the process that we can develop something to address this situation with this level of complexity. It is a reasonable regulatory concept and we would like to carry it to the end point to get to the point to determine whether we have the tools to implement this concept – but we are not at that point yet – this is a challenge that we will need to address as we move forward with this process.
- From a regulatory perspective there would need to be provision to amend a withdrawal permit to allow for the introduction of these credits for permitted withdrawal and allow you to modify it as a minor modification probably. That is accurate but it would be subject to consideration of any public comment that the agency received on the modification request. DEQ would need to be able to go back and determine that they can withdraw the additional water without any adverse impact to the aquifer. The agency needs to have the opportunity to ensure that the withdrawal is appropriate and will not adversely impact the aquifer.
- It was suggested that the wording of the definition should be revised to read: "the total quantity of injected water that is authorized to be recovered from the aquifer".
- It was suggested that the term "credits" should be "credit" since "credit" would refer to an authorized amount of water.
- It was suggested that the last sentence of the definition should read: "Credit is deposited into the permittee's groundwater storage account at DEQ and retired when authorized water is recovered. (The last phrase "and as water is lost to the system" should be deleted since it is the "recovery factor" which is addressed in the next definition.)

- *Recovery factor*: the annual fraction of the remaining injected water that is available for recovery by the permittee. The recovery factor is calculated as one minus the annual water loss rate (rate at which injected water is lost for recovery).
  - Do we want to define the "recovery factor" specifically as the estimate of the loss to the system? Loss to the confined aquifer? It was suggested that it would be better to keep it as a generic loss rate. Not sure what kind of arguments that might be raised if we change it to say "to the aquifer system". What if someone were to day that we need a "cut to the aquifer" like they do in Arizona? What then goes into the "recovery factor"? It is probably the "rate at which the loss is consistent".
  - Do we need to make it explicit as to what goes into the "recovery factor"? It is an annual water loss. Does it have to be an "annual loss rate"? Everything right now is structured

on an "annual" and "10-Year" basis. Another way to approach it would be to average the loss over a certain period. The way the current definition is phrased more accurately reflects how water is loss to the system. It is important for it to be on annual basis is that it is important for the agencies to be able to track at some time interval how much water actually got put into the system. It is great to be able to say at the beginning of a 10-year cycle or longer period that a certain amount is going to be injected but when was that water injected because otherwise identifying and managing those 3rd party impacts becomes very challenging.

- In terms of impacts to the groundwater resource generically time increments less than a year is not significant. Use of time increments greater than 10 years is significant. So 1 year is a nice and convenient number to use in terms of tracking water use in terms of impacts to the groundwater as a resource. There is already an institutional reporting increment of 1-year.
- It was suggested that the wording should be revises from "…recovery by the permittee..." to "…recovery by a permittee…"
- Does "water loss rate" need to be defined? The term probably needs to be defined. It was suggested that it is "the rate at which water is loss".
- It was suggested that the phrase "(rate at which injected water is lost for recovery)" should be deleted from this definition.

- *GW storage account*: VDEQ will maintain and publish annually a groundwater storage account for any permittee holding groundwater storage credits.
  - It was suggested that it should be "DEQ" not "VDEQ".

- *Recovery zone*: the spatial boundary from which injected water may be recovered.
  - It was suggested that the definition should read: "…which injected water is authorized to be recovered."
  - It was suggested that the term should be "spatial extent" or "spatial area" instead of "spatial boundary". It was also suggested that "boundary" might be the preferred term.
  - It was suggested that the definition be revised to read: "the area within the spatial boundary from which injected water is authorized to be recovered".

- *Seasonal storage*: projects recover injected water within the same water year.
  - Is there a definition of water year? Yes, it is October 1st to September 30th. This is a surface water concept, so in this instance it is probably not necessary that it be tied to a "water year".
  - It was suggested that the phrase "within 12 months of injection" might be more appropriate. But, we need to recognize that this is different than the long term storage, this is just a "seasonal use/storage" concept.
  - How does this account for natural recharge?

- Are we talking about a volume of water? Yes, it is the amount of water that you can withdraw within 12 months of injection.
- It was suggested that it is not "a project" it is "a volume of water".
- It was suggested that a possible rewording might be: "injection projects that may withdraw water within 12 months from the time of injection." It was suggested that it is not a project – it is a volume of water.
- It was suggested that the wording should be revised to read: "injected water that may be recovered within 12 months from the date of injection".

- *Long term storage*: injection projects that may withdraw water across multiple years. The aquifer is used for long term temporary storage.
  - It was suggested that the definition should be revised to read: "injected water that may be withdrawn across multiple years."
  - It was suggested that the last sentence of the definition which reads: "The aquifer is used for long term temporary storage" should be deleted.

- ***Groundwater Credit***

  Within existing groundwater management areas, DEQ will grant a *groundwater credit* to any party that injects water into the confined coastal aquifer for purposes of using the aquifer for temporary water storage and recovery.

  A groundwater credit is considered additional to a groundwater allocation granted under a groundwater withdrawal permit. Groundwater allocations shall not be reduced based on injection activity of the permittee.

  A well injection permit would be required before any water is injected into the Virginia aquifers.

- ***Seasonal Storage***

  Recovery factor for seasonal storage shall be 1. (1:1 inject to recovery rate)

  Credit duration: 1 year. Credits not used within the year of being injected will be retired.

  Spatial Recovery: Recovery occurs at the same facility as injection.

  Credit transfer between permittees: None

The Workgroup's Discussion regarding credits and seasonal storage included the following:

- It was suggested that reference to "confined" and "temporary" should be removed from this section.
- Does this envision having credits for both "long-term" and "seasonal" storage? Yes.
- Can "seasonal storage" and "long-term" storage credits work together? How would they work together? Could you do both? Conceptually, you probably don't need to include seasonal storage, but the advantage of keeping it in is that it sets the recovery rate for seasonal storage at 1:1 so someone who needs this temporary/seasonal storage doesn't have to worry about whether they are going to have to deal with an 80% or higher – it is 1:1.
- It is envisioned that at the beginning of the process you would decide if you needed to utilize "seasonal" or "long-term" storage. So an "ASR" would decide at the beginning whether it needed "seasonal" or "long-term" storage.
- If you don't like the idea of "seasonal" then you would go with the "long-term" storage concept.
- It was suggested that it might be advantageous to have the ability to utilize a hybrid approach.
- Seasonal is a short term – actually less than 12 months – more like 3 or 4 month one-time need for "seasonal smoothing" of water supply, for example in time of a drought.
- It was suggested that you could get rid of the "seasonal storage" concept. There is no "banking" with "seasonal". It is a use it or lose it concept.
- If you have a 1 million gallon a year limit, so you inject 1 million one year and you can withdraw 1 million gallons, so that is "1 to 1". The next year, you inject 1 million gallons and you are allowed to withdraw 1 million gallons but you only withdraw .7 million gallons, so it is not "1 to 1". By default, every single year you would be hard pressed to withdraw exactly the amount of water that you injected. It is always going to be something less than that on a long term average. As long as it is from the same site this would be accurate – but that by definition limits your ability to let others use it.
- Most people will use the "seasonal storage" option for their own purposes. It was suggested that the stipulation that "seasonal storage" was only to be used by the permittee injecting the water and would not be available for "trading" purposes.
- The question appears to be whether you would apply the "recovery factor" in the first year or not.

Kurt referred to the handout related to calculation of the annual loss rate (included below):

	Annual loss rate	0.025				
	Gallons injected	1,000,000				
			Withdrawals	Available GW Storage Credits	Recovery Factor	Losses to the system	
	Year 1	1,000,000	-	1,000,000	1	-	
	Year 2	1,000,000	100,000	877,500	0.975	22,500	
	Year 3	877,500	-	855,563	0.975	21,938	
	Year 4	855,563	-	834,173	0.975	21,389	
	Year 5	834,173	700,000	130,819	0.975	3,354	
	Year 6	130,819	-	127,549	0.975	3,270	
	Year 7	127,549	-	124,360	0.975	3,189	
	Year 8	124,360	-	121,251	0.975	3,109	
	Year 9	121,251	-	118,220	0.975	3,031	
	Year 10	118,220	-	115,264	0.975	2,955	Balance
	Sum		800,000	115,264		84,736	1,000,000

The Workgroup's Continued Discussions regarding credits and seasonal storage included the following:

- The losses to the system begin after Year 1 in the example provided.
- From the standpoint of the resource you are still losing some water, but from the standpoint of trying to encourage use of the system, we are talking a very small percentage of loss. Long-term it is not a large impact.
- Do we need to include the concept of seasonal storage if for nothing more than administrative ease? Administrative ease is the thought process on the stuff that is to come. Would there be a skinnier process – a more streamlined process for seasonal? The presumption is that some kind of streamlined permitting would have to be developed to address this concept.
- For long-term storage you would need to go through some level of analytical exercise to figure out what your recovery rate is and some form of analytical exercise to determine the extent of your impact or your recovery area. You would not have to go through those exercises with seasonal storage because you are saying that I just need to some additional water to carry me over during the summer and I need a place to store water temporarily until it is needed (for summer use). It is not likely that people you are injecting water are going to be the main users of seasonal use – people are going to want to buy credits because they do not have current capacity to get through an unexpected event. So we would want to make this option as simple as possible administratively, so that when the need arises that it can be accessed and used. If you are going to actually invest in an injection system, you are going to work it all out upfront as a long term storage you are not going to worry about "seasonal", at least on a conceptual level.

- Do we want to take the "seasonal" concept out of the strawman? It is probably needed as a stopgap measure for whoever wants to use it, but it is unlikely that people who are actually going to pay the expense of injecting water are going to use the seasonal concept.
- Are we then talking more of a "seasonal credit" purchase rather than a "seasonal storage" concept? Yes, probably along the lines of a purchase of "seasonal credits" from storage. The expectation would be that you would need it every year.
- The "cut-to-the-aquifer" was discussed. (Losses to the system).
- The "seasonal" concept is that you would put water into the aquifer and take it out at the same location within the same year. You would get a credit for 1 year that would be retired after that year. It is temporary storage. This is a special condition – the exception to the concept of "long-term storage.

Long Term Storage

Recovery factor: Recovery factors will be based on estimated *annual aquifer losses* using the groundwater model. Guidelines for estimating aquifer losses will be published and updated by VDEQ. For projects injecting into the Potomac coastal plain aquifer, the recovery factor shall not be less than 0.95

A recovery factor schedule covering 10 years will be established by VDEQ. Once established, the schedule shall not be modified downward.

VDEQ may establish maximum annual limits on the rate of withdrawal from recovery wells.

Credit duration: Credits have 10 year useful life. All credits remaining after 10 years will be permanently retired.

Spatial Recovery: Recovery can occur off-site of the injection location. The spatial recovery zone will be delineated during the permitting process. DEQ will develop guidelines for defining the spatial recovery zone. The spatial recovery zone will defined to the maximum extent practicable and subject to reasonable expectations that no adverse impacts will be imposed on third party users.

Credit transfer between permittees: Groundwater storage credits may be transferred to another party within the spatial recovery zone.

The Workgroup's Discussion regarding credits and long term storage included the following:

- For example: Annual aquifer loss = 1 percent per year – unavailable for recovery. Recovery factor of .99. You can recover 99 percent of the water that you inject. That recovery factor would be applied every year that you have credits. This would be a rolling calculation over the 10 year period.
- The recovery factor would be dependent on the modeling process and would need to be defined upfront so that everyone would know what the range of loss rates are. It would have to be defined on a case-by-case basis.
- A question was raised as to why in the strawman was the recovery factor capped at 0.95? It could be taken out but it provides some "floor" as a worst case scenario. It provides a little bit of certainty to the process. Having a lower bound makes sense, but for the sake of this exercise we could say that the lower bound is "to be determined". The model runs may show a different recovery factor or an even lower factor than the 0.95. Let's defer that number until we can determine through the model runs as to what is reasonable.
- The "10 year" duration is used in the strawman because that is what Nevada is using, so the number could be different.
- A question was raised as to why there is a recovery factor for the Potomac coastal plain aquifer? We keep hearing that there is loss to the system, but where does it go? Why is it treated as a loss? Based on experience and the modeling, the loss to the system goes up into the overlying aquifer and eventually some portion goes into surface water. The natural water balance originally was for it to go to surface water or the ocean. The concept is that the water that is "a loss to the aquifer" is water that is not available for pumping. Loss is the differential in pressure heads between wells.
- We have to account for loss even though it is variable. It is arbitrary to set a cap on the recovery factor right now. This should be left as "to be determined".
- Should there be a 10 year or any year factor? As long as we are applying the recovery rate every year there is probably no need to have an end date. The problem is what is out there that we don't know, so maybe a "10-year re-evaluation cycle". It was suggested that it should not be an expiration of or retirement of credits but a "re-evaluation" of credits every 10 years. The recovery rate would be fixed for 10 years and then re-evaluated at that time and then set for another 10-year period based on that evaluation.
- The sentence related to the recovery factor schedule that reads "Once established, the schedule shall not be modified downward" is to give the applicant certainty for that 10 year period of a set recovery factor.
- The 10-year period would be a rolling 10-year period so that each year that an amount is injected would have advantage of a 10-year period to work with.
- It would no longer be a use it or lose it after 10 years, we are just letting it depreciate over a 10-year period and re-evaluated at 10 years. The limit is the rate of depreciation.

- It was suggested that the sentence related to the recovery factor schedule should be revised to read: "A recovery factor schedule covering 10 years will be established by DEQ. Once established the 10-year schedule shall not be modified. At the end of the 10-year period the schedule will be re-evaluated and the recovery factor may be revised based on new information." Even with this re-evaluation the previous credits are still in the account and available.
- It was suggested that the sentence related to "credit duration" should be deleted.
- The group discussed "spatial recovery".
- It was suggested that the phrase "no adverse impacts to the groundwater resource" should be added to the "spatial recovery" language and reference to "third party users" could be deleted.
- It was noted that the credits used by a third-party user may not be on a 1:1 basis because of the pressure relationship, for example: they may have 200 credits but at their location they only can pump 100 credits without adversely impacting the aquifer. The model run would dictate how many credits that the third-party user could purchase for their location.
- It was suggested that language should be added to indicate that the "spatial recovery" zone would be re-evaluated every 10 years.
- In the analysis we can estimate what the percentage drawdown of every cell from every user so it is possible to identify the head gain in each cell that is the responsibility of the injector.
- We are here because there is an "overdraft" issue that we need to address. There has to be a "cap".
- The "cap" is spatial dependent.
- It was suggested that maybe we need to identify a base-line year figure or what the system would look like with no injection.
- The base-line is the major question that needs to be addressed. It was suggested that we need to flesh out that information using the two existing projects (the Chesapeake ASR Well and the HRSD project) in more detail for a follow-up meeting.

ACTION ITEM: Scott and Britt will get together on June 7th to work on an example of what the impact of the two proposed projects (Chesapeake ASR and HRSD) would have on the system.

- Do we need to keep the concept of "seasonal storage" which is the exception to the rule? We do need to have it as a short-term measure to address emergency needs – a simplified permitting process would be needed. Seasonal is a business decision.
- Demand is always the issue.
- It was suggested that there is no market without having a closed system. Someone is going to have to say that someone is not going to get water. There has to be a closed system for a trading concept to work.
- The group had a lengthy discussion on the use and purchase of credits and the market for those credits and whether to have a closed system or not.
- The group talked about "supply" and "demand" issues.

- We need to look at the water that is available for credits and withdrawal based on both a "pre-injection" and a "post-injection" status.

5. **Scheduling and Next Steps (Mark Rubin):**

Mark Rubin thanked everyone for their input to the process today and noted the following:

- We will revise the strawman based on today's discussions and route it back out to the group for review and comment. That input will be incorporated into an "interim work product" for presentation to the Advisory Group at their meeting on June 24th.

6. **Public Comment:**

No Public Comment was offered.

7. **Meeting Adjournment:** Mark Rubin thanked everyone for their attendance and participation in today's meeting. The meeting was adjourned at approximately **4:15 P.M.**