

COUNCIL OF THE CITY OF PHILADELPHIA
COMMITTEE ON STREETS AND SERVICES

Via Microsoft Teams
Philadelphia, Pennsylvania
Thursday, March 10, 2022
1:09 p.m.

PRESENT:

COUNCILMAN ISAIAH THOMAS, CHAIR
COUNCILWOMAN CINDY BASS
COUNCILWOMAN KENDRA BROOKS
COUNCILWOMAN KATHERINE GILMORE RICHARDSON
COUNCILMAN DAVID OH
COUNCILMAN MARK SQUILLA

RESOLUTION 220132 - Resolution authorizing the
Committee on Streets and Services to hold
hearings regarding Beets, Brine and Salt
regarding the recipe for Philadelphia's
Streets in Winter in order to advance our
interests in safe roads, healthy streams and
good stewardship of resources and the
taxpayers funds.

- - -

1 3/10/22 - STREETS - RES. 220132

2 COUNCILMAN THOMAS: Good
3 afternoon, everybody. Today is Thursday,
4 March 10, 2022. This is the Committee on
5 Streets and Services hearing, and I want
6 to welcome everybody to today's hearing.

7 I understand that state law
8 currently requires that the following
9 announcement be made at the beginning of
10 every remote public hearing as follows:

11 Due to the current public
12 health emergency, City Council committees
13 are currently meeting remotely. We are
14 using Microsoft Teams to make these
15 remote hearings possible. Instructions
16 for how the public may view and offer
17 public testimony at any public hearings
18 of City Council -- of Council committees
19 are included in the public hearing
20 notices that are published in the Daily
21 News, the Inquirer, and the Legal
22 Intelligencer prior to the hearings, and
23 can also be found on PHLCouncil.com.

24 I note that the hour has come.
25 Ms. Golden, will you please call the roll

1 3/10/22 - STREETS - RES. 220132

2 to take attendance.

3 Members that are in attendance,
4 will you please indicate that you are
5 present when your name is called. Also
6 please say a few brief remarks when
7 responding so that your image will be
8 displayed on screen.

9 Madam Clerk.

10 THE CLERK: Vice Chair Squilla.

11 COUNCILMAN SQUILLA: Good
12 morning, Mr. Chair and colleagues.
13 Present.

14 COUNCILMAN THOMAS: Good
15 afternoon.

16 THE CLERK: Councilwoman Bass.

17 COUNCILWOMAN BASS: Good
18 afternoon, Mr. Chairman and colleagues
19 and the City of Philadelphia.

20 COUNCILMAN THOMAS: Good
21 afternoon.

22 THE CLERK: Councilman Oh.

23 COUNCILMAN OH: Good afternoon.
24 I'm present.

25 COUNCILMAN THOMAS: Good

1 3/10/22 - STREETS - RES. 220132

2 afternoon.

3 THE CLERK: Councilwoman

4 Brooks.

5 COUNCILWOMAN BROOKS: Good

6 afternoon. I'm present.

7 COUNCILMAN THOMAS: Good

8 afternoon.

9 THE CLERK: Councilman Johnson.

10 (No response.)

11 THE CLERK: Councilmember

12 Gilmore Richardson.

13 (No response.)

14 THE CLERK: And Chairman

15 Thomas.

16 COUNCILMAN THOMAS: I'm

17 present.

18 And thank you, everybody. A
19 quorum of the Committee is present. This
20 hearing is now called to order. This is
21 the public hearing of the Committee on
22 Streets and Services regarding Bill No.
23 220132.

24 Ms. Golden, will you please
25 read the titles of the bills for today.

1 3/10/22 - STREETS - RES. 220132

2 THE CLERK: 220132, resolution
3 authorizing the Committee on Streets and
4 Services to hold hearings regarding
5 Beets, Brine and Salt regarding the
6 recipe for Philadelphia's Streets in
7 Winter in order to advance our interests
8 in safe roads, healthy streams and good
9 stewardship of resources and the
10 taxpayers funds.

11 COUNCILMAN THOMAS: Before we
12 begin to hear testimony from the
13 witnesses we have before us today,
14 everyone who has been invited to the
15 meeting to testify should be aware that
16 this public hearing is being recorded.

17 Because the hearing is public,
18 participants and viewers have no
19 reasonable expectation of privacy. By
20 continuing to be in the meeting, you are
21 consenting to being recorded.

22 Additionally, prior to
23 recognizing members for questions or
24 comments they have for the witnesses, I
25 will note for the record at this time

1 3/10/22 - STREETS - RES. 220132
2 that we will use the Chat feature
3 available in Microsoft Teams to allow
4 members to signify that they would like
5 to be recognized. In order to comply
6 with the Sunshine Act, the Chat feature
7 must only be used for this purpose.

8 Ms. Golden, will you please
9 call -- well, you called the bill
10 already. So will you please call the
11 bill again and we will begin to hear from
12 our witnesses this afternoon.

13 THE CLERK: We'll be hearing
14 one resolution, 220132. The first
15 witness we'll hear from is Streets Deputy
16 Commissioner Rich Montanez.

17 COUNCILMAN THOMAS: Good
18 afternoon. Please state your name for
19 the record and you may begin with your
20 testimony.

21 DEPUTY COMMISSIONER MONTANEZ:
22 Good afternoon, Chairman Thomas and
23 members of the Streets and Services
24 Committee. My name is Richard Montanez,
25 Deputy Commissioner for Transportation

1 3/10/22 - STREETS - RES. 220132
2 for the Department of Streets. Here with
3 me is Steve Lorenz, Chief Highway
4 Engineer for the Department of Streets.
5 I'm here today to present testimony on
6 Resolution No. 220132 regarding the use
7 of beets, brine, and salt in the winter
8 to treat roadways during snow events.

9 When performing winter
10 operations during an event, there is a
11 balance between clearing the street with
12 salt and being mindful of the
13 environment. It is important to make
14 sure all streets are clear of snow and
15 ice for safe travel. This is not only
16 important for the safety of the users of
17 the road, but also to keep commercial
18 moving in and out of our city.

19 In addition, not only do we use
20 salt in the winter operations, but we
21 also support the Philadelphia Water --
22 I'm sorry. We also support the
23 Philadelphia Water Department with the
24 water main breaks; SEPTA for troubled
25 locations; Parks and Recs for their

3/10/22 - STREETS - RES. 220132

trails; and the Fire Department for the icy conditions that are as a result of fires.

There are hundreds of different scenarios that a winter storm can bring, ranging from freezing rain and ice up to a 22-inch blizzard that occurred in 2017. Also, Philadelphia is unique in its geography, which presents challenges.

The meteorologists always refer to the rain/snow line along the I-95 corridor. One of the reasons it was constructed along the Delaware River was because of the weather condition being between the ocean and the mountain.

There is also a 500-foot difference between the Philadelphia International Airport and the hills of Chestnut Hill. It is possible to have rain in South Philly while snowing up to six inches in the Far Northeast and Northwest.

Along the Schuylkill River, the temperatures can be lower than the rest

1 3/10/22 - STREETS - RES. 220132

2 of the City due to the river.

3 Salt is the most effective and
4 quickest way to treat roadways, not only
5 within the City but also across the
6 country. However, there are
7 environmental impacts. Salt is a metal,
8 and when it gets into our streams and
9 rivers, it is difficult to remove. Also,
10 too much salt can be destructive to
11 certain species of vegetation. As a
12 city, we try to be mindful of this and
13 have made efforts over the last ten years
14 to try to find a balance between treating
15 the streets and protecting the
16 environment.

17 The best progress that we have
18 made is to educate the users of the salt.
19 For years, the philosophy was more salt
20 is better. The City has a capacity to
21 stock over 50,000 tons of salt, but that
22 does not mean that we use it.

23 Other efforts to minimize the
24 salt are, we eliminate mostly dry
25 salting. Dry salting is treating the

1 3/10/22 - STREETS - RES. 220132
2 roads prior to the start of a winter
3 event. Salting now begins when the snow
4 starts to fall.

5 Calibrating the augers and
6 spreaders in the back of our truck so
7 that they are not spreading full. On
8 most City streets, a low and medium
9 setting is appropriate.

10 Exploring different types of
11 roadway surfaces that have larger
12 aggregates that will hold the salt and
13 act as anti-skid.

14 Before winter, the Streets
15 Department and the Office of Emergency
16 Management hold separate winter workshops
17 where salt usage is discussed. Topics
18 that are mentioned include the downside
19 if the City runs out of salt; effects of
20 salt as it pertains to the MS-4 permit.
21 MS-4 is short for Municipal Separate
22 Storm Sewer System, where the word
23 "municipal" refers to the unit of a local
24 government responsible for administration
25 of the developed area; how salt affects

1 3/10/22 - STREETS - RES. 220132

2 PWD's effort to treat water/wastewater;
3 the proper maintenance of vehicles to
4 spread the salt.

5 Increase the use of brine. The
6 Administration has invested in our
7 brining efforts by purchasing two
8 trailers, replacing the City's flusher
9 trucks, and purchasing two trucks that
10 can be retrofit with water tanks that can
11 be used for brine.

12 Brine is an effective proactive
13 way to get ready for a winter event.
14 Brine is a saltwater mixture that gets
15 applied to the road surface about 48 to
16 72 hours prior to a known winter event.
17 If there is rain in the forecast prior to
18 the snow event, we do not brine.

19 The Streets Department has
20 worked brine into our winter operations
21 plan. We have two brine-making stations,
22 so we do not need to purchase any
23 ready-made brine. Brine acts as an
24 anti-bonding agent where the snow will
25 start to melt before it bonds to the

3/10/22 - STREETS - RES. 220132

road. This gives enough time for the salt trucks to appropriately treat the road. We focus on higher level streets and primary roadways with the brine. If there are no special events during the winter event, we will pre-treat those roadways as well. Brine can melt up to one inch of snow depending on how fast the snow comes down.

The City does not use beet juice in our brining operations. Beet juice is a by-product of sugar beets. After the beet is refined into sugar and other agricultural usage, the silage is put into a liquid form. Salt and brine are not as effective when the surface temperatures fall below 18 to 20 degrees. Beet juice will allow the brine to work at lower temperatures. It is a rare occurrence when the City falls into low periods of low temperature where beet juice will be needed. When it has in the past, daytime temperatures are in the 20's with the sun. This will activate

1 3/10/22 - STREETS - RES. 220132

2 the salt. We discussed the usage of beet
3 juice years ago and determined that the
4 benefits did not justify the usage.

5 Other reasons we did not pursue
6 the use of beet juice is that beet juice
7 does not have a shelf life where it can
8 be used following the season. The brine
9 stations needed to be retrofit to add
10 beet juice into them. PWD will need to
11 review their water treatment operations
12 to see what needs to be added to treat
13 additional biological residue.

14 Whatever beet juice remains on
15 the street after the snow event will
16 start to smell like rotten vegetables
17 until there is precipitation that washes
18 it away.

19 PWD holds and updates the
20 City's MS-4 permit with the Pennsylvania
21 Department of Environmental Protection.
22 The MS-4 permit regulates the City's
23 responsibility of hazards going into the
24 rivers and streams. The Streets
25 Department is a partner with PWD for the

1 3/10/22 - STREETS - RES. 220132

2 MS-4 permit.

3 The Managing Director's Office
4 created the Clean Water Task Force in
5 which salt is the topic of conversation.
6 We require all salt to be stored within a
7 covered structure and delivered to be --
8 excuse me; and deliveries to be moved
9 into structures as quickly as possible.
10 Also, efforts are being made to protect
11 yard drainage near the salt structures.
12 In the event salt is stored uncovered,
13 tarps are used.

14 I would like to use this
15 opportunity to thank all of the City's
16 partners who help with providing
17 assistance in keeping the roadways clear
18 of snow and ice - PWD, Fleet Services,
19 the Sanitation Division of the Streets
20 Department, OEM, CLIP, the Philadelphia
21 Housing Authority, Parks and Recs,
22 Police, the Philadelphia Parking
23 Authority, Prisons, and the Pennsylvania
24 Department of Transportation.

25 This concludes my testimony,

1 3/10/22 - STREETS - RES. 220132

2 and I will be happy to answer any
3 questions you have.

4 COUNCILMAN THOMAS: Thank you
5 for your testimony.

6 I think what we're going to do
7 is, we're going to allow the entire panel
8 to testify, and once the entire panel
9 testifies, we'll open up for questions.

10 So, Madam Clerk, if you can
11 call our next witness for this panel.

12 THE CLERK: The next witness is
13 John from PennDOT.

14 COUNCILMAN THOMAS: Good
15 afternoon, John. Please state your name
16 for the record and you may begin with
17 your testimony.

18 MR. KRAFCZYK: Good afternoon,
19 Councilpeople. My name is John Krafczyk.
20 I am currently the Senior Assistant
21 District Executive for Maintenance for
22 PennDOT, Engineering District 6-0. I was
23 asked to speak about our treatment
24 processes and services during winter
25 events.

1 3/10/22 - STREETS - RES. 220132

2 So there are a number of things
3 we do, some very similar to the City, as
4 Rich has talked about. Pre-treating
5 pavements prior to a winter storm, we
6 refer to that as anti-icing, and we do
7 use a salt brine, which we manufacture
8 ourselves, which is basically a water
9 solution with 23 percent salt suspended
10 in it.

11 Salt brine application rates
12 depend on temperatures. When we are at,
13 you know, 25 degrees or above, we're
14 applying it roughly 45 gallons per mile.
15 When expected temperatures are 15 to
16 24 degrees, we're as high as 60 gallons
17 per mile.

18 We apply them similar. We have
19 a few tanker trucks, but mainly we have
20 slide-in units, tanks, equipped with
21 spray bars that we can slide into our
22 truck fleet.

23 Some of the benefits of that
24 are better pavement conditions can be
25 achieved at the offset of the storm,

1 3/10/22 - STREETS - RES. 220132
2 reducing the number of crashes. It does
3 prevent or inhibit the bond of snow pack
4 to the roadway. So in the event that you
5 do get snow pack, it would take
6 significantly less chemical to remove
7 that snow pack than had you not brined.

8 Cleanup after the storm
9 oftentimes is easier because of the less
10 ice bonded to the roadway.

11 Applying brine ahead of the
12 storm jump-starts the melting process or
13 the process of improving the conditions.
14 Brine sticks to the roadway surface.
15 It's not easily blown off. So the
16 material used is pretty effective, more
17 effective than putting dry salt onto the
18 road, which is often dissipated or blown
19 off the road by vehicles.

20 And it increases efficiency
21 results and use of less deicer and
22 manpower, therefore lowering the cost of
23 maintaining.

24 During -- we only apply these
25 brines ahead of snow, sleet, and freezing

1 3/10/22 - STREETS - RES. 220132

2 rain. If the temperatures are warmer and
3 it's starting out as plain rain, we do
4 not apply brine, only because it would
5 just certainly be washed off the
6 roadways.

7 During a storm, our treatments,
8 we put a lot of emphasis on planning. So
9 we lay out truck routes and cycle times.
10 The idea of cycle time for a truck is
11 between two and three hours per cycle,
12 meaning the point at which he starts,
13 when he completes his loop, he gets back
14 to his starting point within the two-,
15 three-hour timeframe. The reason for
16 this is to give time for the salt to
17 work.

18 A common misunderstanding is
19 salt melts snow. Salt does not melt
20 snow. Salt lowers the freezing point of
21 water, so salt needs to be in a solution
22 for it to work. So applying salt to snow
23 through the action of the traffic, it
24 generates mighty particles of moisture,
25 which then turns into lowering the

1 3/10/22 - STREETS - RES. 220132
2 freezing point of water on the roadway.

3 So ideally on the -- achieve
4 our cycle times on interstates and
5 expressways, we plan for roughly 20 snow
6 lane miles per truck. On our BPN-2,
7 which is one of our higher networks but
8 not to the interstate level, we're about
9 25 snow lane miles per truck.

10 Our third business plan
11 network, we're up to 30 miles, and our
12 back roads, rural roads, our snow lane
13 miles, 35 miles per truck. Again, we
14 shoot for times of two to three hours on
15 cycle times.

16 Salt needs time from work.
17 From the time you put it down until you
18 actually see some benefit can be anywhere
19 from an hour to two hours. Cycling too
20 often, especially when plowing, is a
21 waste of salt. You're just plowing off
22 or adding more salt to the salt that's
23 already in place, which you haven't given
24 time to work.

25 Contrary to belief, more salt

3/10/22 - STREETS - RES. 220132

isn't better. When you look at the freezing point at which salt lowers the water, it can go down to as low as 16, 17 degrees. However, as you continue to add more salt to that solution, that temperature will slowly rise. So the freezing point of water by adding too much salt can go above that up into the 20 degrees.

So we spend a lot of time educating our truck drivers on the science of winter and, you know, explain it and demonstrate it to them so they understand.

So rock salt with no pre-wetting application rates at 25 degrees or above is 120 pounds per snow lane mile. We do gauge our salt uses based on pavement temperatures.

Application rates below 25 degrees, we can go up as high as 210 pounds per snow lane mile. Our systems in our trucks have the ability to calibrate to pounds per mile rather than

1 3/10/22 - STREETS - RES. 220132

2 low, medium, high, so we can be pretty
3 precise with our application.

4 One of the things we moved to
5 in the past ten years is pre-wetting our
6 salt with brine, and what that does is it
7 provides the moisture to the salt and is
8 sprayed on the salt as it's applied to
9 the roadway. So the salt is already in
10 solution by the time it hits the roadway,
11 so it acts quicker and works better and
12 allows us to use more salt -- or less
13 salt.

14 Application rates when we're
15 pre-wetting, the salt can -- at
16 25 degrees or above can reduce our
17 application rate to 100 pounds per snow
18 lane mile, and application rates below 25
19 can reduce to 170 pounds per mile.

20 So by the use of pre-wetting
21 salt, we can reduce our salt usage during
22 a storm by 20 to 30 percent. So you may
23 think while you're still spraying it with
24 a salt brine, but we spray our salt at 6
25 and 12 gallons per ton, which interprets

1 3/10/22 - STREETS - RES. 220132
2 into 8.3 pounds per gallon. So on
3 average per ton, we're adding two pounds
4 of chloride to it. So that's next to
5 nothing, but we're reducing our rock salt
6 uses by 20 to 30 percent.

7 I'm going to jump right into
8 additives that we can use in the brine.
9 So Rich had mentioned the Beet Heet,
10 which is de-sugared beet molasses. There
11 are a number of other products on the
12 market. PennDOT did several years ago
13 work with Temple University to conduct
14 studies on the -- for the alternative
15 products that were on the market at the
16 time. Pacific Northwest Snowfighters did
17 extensive testing in conjunction with
18 clear roads. And so not readily
19 understood is, because it is an
20 agricultural product doesn't mean it's
21 all natural and safe to our roadways. So
22 the actual de-sugared beet molasses in
23 its raw form does nothing to melt snow.

24 All these products, when
25 subject to chemical analysis, have

1 3/10/22 - STREETS - RES. 220132

2 chlorides added to them. I believe
3 de-sugared -- the Beet Heet uses, I
4 believe, sodium and calcium chloride
5 that's added to it to make it effective.
6 Other products can use magnesium
7 chloride, magnesium acetate, potassium
8 acetate, all which are chlorides, which
9 can add to our issues.

10 Our studies, we did pilot some
11 of this in some of our western districts
12 known as our Snow Belt where we get a lot
13 of snow, and they saw no significant
14 difference in using this material over
15 plain salt brine. The only advantage
16 they did recognize is during extremely
17 low temperatures, it did make the salt a
18 little bit more effective.

19 These products are manufactured
20 and expensive and require separate
21 material handling systems and storage
22 systems in our stockpiles, which we just
23 don't have, and would be a significant
24 cost to be able to handle these
25 materials. And, again, they cannot be

1 3/10/22 - STREETS - RES. 220132

2 kept from year to year, where salt brine
3 we can.

4 That calcium chloride is right
5 now our preferred method of dealing with
6 lower temperatures, temperatures below
7 16 degrees. The way we use that, as the
8 trucks come in and load their trucks, we
9 add, depending on the temperature, one to
10 two bags of bagged calcium to each bucket
11 of salt that goes into the truck. This
12 has proven to be the most effective
13 application for us. We only use it when
14 we get in extreme temperatures. We can
15 store the bags in roof-enclosed
16 buildings, which gives it a long shelf
17 life, and, you know, this particular
18 winter, we didn't use any. So often
19 winters will go by with pallets of the
20 stuff laying there that we don't use, but
21 when we do have a winter storm, that's
22 what we have done.

23 Liquid magnesium chloride we
24 have used in the past. The issue with
25 that is, number one, the cost. It's very

1 3/10/22 - STREETS - RES. 220132

2 expensive. For the amount of times we're
3 dealing with temperatures that low, it's
4 not worth -- again, these liquid mag
5 would require some sort of storage
6 infrastructure, which we just do not
7 have. Shelf life is questionable. You
8 can't mix it with your normal salt brine
9 without constant agitation, because it
10 does separate very quickly, as does
11 liquid calcium.

12 So that would conclude my
13 testimony, unless there were any specific
14 questions.

15 COUNCILMAN THOMAS: Thank you
16 for your testimony. We'll circle back
17 around with questions once this panel
18 concludes.

19 Madam Clerk, can you please
20 call the final member of this panel?

21 THE CLERK: The last witness
22 for this panel is Jana Tidwell.

23 COUNCILMAN THOMAS: Good
24 afternoon. Please state your name for
25 the record and you may begin with your

1 3/10/22 - STREETS - RES. 220132

2 testimony.

3 MS. TIDWELL: Good afternoon,
4 Councilman Thomas and members of the
5 Streets and Service Committee. My name
6 is Jana Tidwell and I am the Manager of
7 Public and Government Affairs for AAA
8 Mid-Atlantic. On behalf of AAA
9 Mid-Atlantic, I am here to present our
10 concerns about the damaging effects of
11 salt and brine on vehicles.

12 In regions in the U.S. where
13 winter weather is prevalent, deicers are
14 used before, during, and after storms to
15 make the roadways safe for travel. For
16 many years, transportation departments
17 have used rock salt or liquid deicers to
18 combat snow and ice on the roads.
19 Unfortunately, these chemicals can also
20 rust and corrode vehicle components.

21 In recent years, many state and
22 local transportation departments have
23 shifted from using rock salt to liquid
24 deicers to combat ice and snow on
25 roadways. These newer alternatives are

1 3/10/22 - STREETS - RES. 220132
2 more effective than traditional salt
3 because they can be applied before a
4 snowstorm. They have a lower freezing
5 point and melt ice and snow faster, as
6 we've heard today.

7 However, these same
8 characteristics can be even more damaging
9 to vehicles since the chemicals remain in
10 liquid form longer and are more likely to
11 coat components and seep into cracks and
12 crevices where corrosion can accelerate.

13 Beyond cosmetic issues, rust
14 damage can cause serious and dangerous
15 damage to a vehicle's brakes, fuel tank,
16 and exhaust systems. Fortunately, this
17 prevalent issue can be lessened with
18 proper vehicle maintenance.

19 According to a AAA survey that
20 took place from 2016 to -- I'm sorry;
21 from 2012 to 2016, a five-year period,
22 seven in ten U.S. drivers either
23 currently live or in the past five years
24 have lived in a winter weather climate
25 region. Half, 51 percent of U.S. drivers

1 3/10/22 - STREETS - RES. 220132
2 living in winter climates, are concerned
3 about the damage that salt and other
4 chemicals used to melt snow and ice on
5 roadways may cause to their vehicle.

6 In the past five years,
7 15 percent of U.S. drivers living in
8 winter climate regions had to get their
9 vehicle repaired at least once because of
10 rust damage caused by salt and other
11 chemicals used to melt snow and ice on
12 roadways.

13 In total, the cost to repair
14 salt-related rust damage is estimated at
15 \$15.4 billion over that five-year period,
16 and on an annual basis, rust-related
17 damage is estimated to cost U.S. drivers
18 more than \$3 billion.

19 Among those who had at least --
20 and those are again numbers from a recent
21 AAA study about deicers and salt damage
22 to vehicles.

23 AAA is always concerned, as are
24 those who have previously testified
25 today, about the road's safety, keeping

1 3/10/22 - STREETS - RES. 220132
2 people safe on the roads before, during,
3 and after storms. However, we're also
4 concerned with the damage that these snow
5 and ice-melting chemicals and salt can do
6 to vehicles if not properly maintained.

7 That concludes my testimony.

8 COUNCILMAN THOMAS: Thank you
9 for your testimony.

10 Before we open it up for
11 questions from members of this Committee,
12 I just want to note for the record that
13 Councilmember Gilmore Richardson is
14 present and has joined us this afternoon.

15 I do want to again thank
16 everybody for their testimony. I want to
17 ask my colleagues, members of this
18 Committee, if anyone has any questions
19 for this particular panel.

20 I'll start myself. If anyone
21 has any questions, please just indicate
22 in the Chat feature that you would like
23 to be recognized.

24 My first question is, listening
25 to a lot of the issues from dealing with

1 3/10/22 - STREETS - RES. 220132
2 the salt, not just the pollution as it
3 relates to our local bodies of water but
4 also thinking about infrastructure
5 issues, I am clearly the Chair of Streets
6 and Services, and outside of illegal
7 dumping, one of the things that people
8 reach out to us all the time about is
9 potholes.

10 So can you just take a minute
11 to talk to us about the impact that using
12 the methods that we're currently using
13 has on the number of potholes that we see
14 in the City and what can we do to
15 essentially address that huge concern,
16 because constituents reach out to us all
17 the time about the pothole issue.

18 DEPUTY COMMISSIONER MONTANEZ:
19 John, you want to touch that one first or
20 do you want me to go first?

21 MR. KRAFCZYK: By all means,
22 Rich, you go first.

23 DEPUTY COMMISSIONER MONTANEZ:
24 So, Councilmember, Richard Montanez,
25 Deputy Commissioner of Streets. With me

1 3/10/22 - STREETS - RES. 220132

2 is also Steve Lorenz, who is the Chief
3 Engineer.

4 Potholes are mainly due -- yes,
5 water is a factor of potholes, but it has
6 to do with the free/thaw cycles that
7 Philadelphia sees. For example, this
8 past Sunday was 70 degrees. A couple
9 days later we were down in our 20's. So
10 that freeze/thaw cycle within the City
11 kind of moves the earth in a way,
12 creating small cracks on our asphalt,
13 which then lets water penetrate. When
14 water freezes, once again it pops up. So
15 although the brine solutions that we use
16 are laid on top of the asphalt, they
17 contribute to the life of the road, but
18 not to the pothole amount or the amount
19 of potholes. It has to do with the
20 freeze/thaw cycle and how much moisture
21 we have.

22 Steve, John, you guys want to
23 add anything to that?

24 MR. LORENZ: No. Actually,
25 again, Councilmember, my name is Steve

1 3/10/22 - STREETS - RES. 220132

2 Lorenz, Chief Highway Engineer for the
3 Streets Department.

4 Just to add to what the Deputy
5 Commissioner has said, the best way to
6 maintain roadways and eliminate potholes
7 is to have a good paving program. This
8 year we, thanks to the efforts of the
9 current Administration, we are aimed --
10 we are funded to pave about 70 miles of
11 roadway across the City. In Calendar
12 Year 2023, hopefully another 70 miles.

13 The streets we picked were some
14 of the worst streets that we have within
15 the City. We start putting a good paving
16 program together over time, the number of
17 potholes will reduce. You'll never be
18 able to eliminate potholes.

19 As the Deputy Commissioner also
20 said, freeze/thaw is part of the main
21 cause of the potholes. We are in the
22 Mid-Atlantic region of the United
23 States --

24 COUNCILMAN THOMAS: I'm sorry.
25 Please repeat that. You said what is the

1 3/10/22 - STREETS - RES. 220132

2 main cause of the potholes?

3 MR. LORENZ: I'm sorry,
4 Councilmember. It's the freeze/thaw, the
5 cold weather, warm weather, getting with
6 inside the cracks of the roadways.

7 Being in the Mid-Atlantic
8 region of the United States, we see -- we
9 have more of the fluctuating temperatures
10 than in other parts of the country. I'm
11 not saying other parts of the country
12 don't have pothole issues, but the
13 Mid-Atlantic region is more prone to that
14 problem.

15 COUNCILMAN THOMAS: So --

16 MR. LORENZ: I'm sorry,
17 Councilman. Go ahead.

18 COUNCILMAN THOMAS: No, no, no.
19 John, go ahead. I'm sorry.

20 MR. KRAFCZYK: John Krafczyk
21 with PennDOT.

22 So pretty much mimics their
23 things. First, I want to clear up
24 some -- there's always -- I'm hearing
25 this a lot from people outside of

1 3/10/22 - STREETS - RES. 220132
2 PennDOT, that salt brine is the most
3 destructive thing we've ever used for our
4 roads and for their cars. I want to be
5 very clear on it. Salt brine that we
6 apply is no different than the brine that
7 develops when you place rock salt on
8 snow. It's the exact same thing.
9 There's no difference.

10 As far as potholes, so we both
11 refer to the freeze/thaw cycles. We do
12 go through probably -- we're in the belt
13 that goes through the most significant
14 number of freeze/thaw cycles in the
15 winter, and that's the main cause of our
16 potholes. If we were way north and
17 stayed pretty much below freezing all
18 winter, we wouldn't see the issues we see
19 down here. But we get periods of warm
20 weather with rain and the water gets into
21 those cracks, quick freeze-up overnight,
22 and ice expands and cracks the pavement.

23 Prevention of that, the best
24 thing is a good repaving program, along
25 with a good crack-sealing program. If

1 3/10/22 - STREETS - RES. 220132

2 all our cracks were completely sealed,
3 there would be nowhere for the water to
4 penetrate down into the pavement to cause
5 those potholes.

6 COUNCILMAN THOMAS: So if we
7 are dealing with some of the same climate
8 issues that other cities as far as
9 geographical location are dealing with,
10 have we talked to other cities about best
11 practices and what they're doing to
12 address this issue? Because I heard
13 someone say in their testimony we're
14 always going to have a pothole issue, and
15 I can see that. I think when you look at
16 how big our city is and how active our
17 city is, that on a certain level that
18 problem is going to exist, but it just
19 seems like it's worse than it's ever been
20 before, especially recently, and with us
21 being in a pandemic, one would just think
22 that some of those issues would get
23 addressed, and now that we're coming out
24 the pandemic, we're seeing, hearing, and
25 witnessing the complaints that people are

1 3/10/22 - STREETS - RES. 220132
2 saying that it's just as prevalent as it
3 was before.

4 So if it's not the salt that's
5 creating it and it's other issues such
6 as, I guess you would call it, climate
7 change and the issues with the weather
8 and the inconsistencies with the weather,
9 what are some cities doing and why can't
10 we replicate some of the things that
11 other cities are doing to put us in a
12 position to really just do a little
13 better?

14 MR. LORENZ: Well,
15 Councilmember, if I can, and Deputy
16 Commissioner, I'd like to continue to
17 answer with this. Again, this year or
18 the last couple years, I'll say it this
19 way, we saw a little bit more freeze/thaw
20 than in previous years. A lot of times
21 in previous years where we would get,
22 say, the month of January, it would
23 pretty much stay, you know, below that
24 freezing line or in the month of
25 February, we would get the snow, it would

1 3/10/22 - STREETS - RES. 220132

2 stay.

3 This year and last year, we
4 didn't get as much snow, but we did get
5 more of that fluctuation of freeze/thaw.
6 Okay? So that's why you're seeing more
7 of it over the last couple of years than
8 recently.

9 The other problem that we had
10 is our paving program. Because of
11 funding issues, we were doing the last
12 couple years 35 miles of paving a year.
13 Last year we actually only did 18 miles,
14 and this is across the City where the
15 Streets Department is responsible for
16 approximately 2,200 miles of street.
17 Okay?

18 Again, this year and next year,
19 we're going to increase our mileage to 70
20 each year, and then we'll see what
21 happens, where the following year is at.
22 We'll be dropping back down to 35 miles
23 after Calendar Year 2023. So Calendar
24 Year 2024 going forward, right now we're
25 looking at about 30 to 35 miles.

1 3/10/22 - STREETS - RES. 220132

2 The other challenge that we
3 face in increasing that mileage is the
4 current ADA lawsuit that the City is
5 going up against where the requirements
6 are as we pave a street, we need to
7 upgrade the handicap ramps. Okay? So
8 right now our budget looks like for
9 handicap ramps with the price of them,
10 70 percent of our budget goes to handicap
11 ramps and 30 percent goes to the repaving
12 of streets.

13 When comparing Philadelphia to
14 other cities over the years, we have
15 talked to other cities. Again, they're
16 doing -- they're saying the same thing,
17 the best way to do it is a good paving
18 program.

19 We do similar repairs that
20 other cities do. For example, we have
21 our pothole patcher that we lease. We're
22 able to fill a pothole within a minute,
23 and we go around the City with that and
24 then just manually fill in potholes, you
25 know, with a few guys on the crew and

1 3/10/22 - STREETS - RES. 220132

2 going through and doing the repairs.

3 Now, also, the other problem we
4 have, it's an older city. Not every
5 defect out in the City is a pothole.
6 Okay? You got plumbers ditches, utility
7 trenches, and those cave-ins from the
8 older infrastructure. So those are all
9 things that we try to handle at the same
10 time. We have to handle each problem
11 differently.

12 Rich, I don't know if there's
13 more you would like to add to that.

14 DEPUTY COMMISSIONER MONTANEZ:
15 Just one point. I have a couple more
16 things, Councilmember. Richard Montanez,
17 Deputy Commissioner of Streets.

18 We're more than happy to meet
19 with your office and discuss. As
20 Commissioner Williams has pointed out,
21 the Streets Department needs to get to
22 131 miles of annual paving a year to
23 maintain a state of good repair.

24 COUNCILMAN THOMAS: What was
25 that number again?

1 3/10/22 - STREETS - RES. 220132

2 DEPUTY COMMISSIONER MONTANEZ:

3 131 miles.

4 COUNCILMAN THOMAS: Which is
5 about 100 more than what we're about to
6 do.

7 DEPUTY COMMISSIONER MONTANEZ:
8 Correct, sir.

9 COUNCILMAN THOMAS: Okay. I
10 just wanted to make sure that we're on
11 the same page.

12 DEPUTY COMMISSIONER MONTANEZ:
13 So we need to get to that number in order
14 to maintain a state of good repair. At
15 that point, it will put us in a cycle of
16 paving our streets. There is a
17 recommended cycle.

18 COUNCILMAN THOMAS: Deputy
19 Commissioner, if we were to do -- and,
20 again, I'm asking for myself as well as
21 the listening audience and other members
22 of the Committee. If we were to do that
23 135 miles a year that our Commissioner is
24 recommending, would we have to commit to
25 the initiatives around building the

1 3/10/22 - STREETS - RES. 220132

2 handicap spaces and having access to
3 that?

4 DEPUTY COMMISSIONER MONTANEZ:

5 Yes.

6 COUNCILMAN THOMAS: And you
7 said 70 percent of the revenue that we
8 actually spend on street paving goes to
9 the handicap initiative. So it wouldn't
10 just be the 135 miles. It would have to
11 be that number of different
12 handicap-accessible sidewalks as well
13 too. Am I understanding that correctly?

14 DEPUTY COMMISSIONER MONTANEZ:

15 That is correct, sir.

16 COUNCILMAN THOMAS: Go ahead,
17 Deputy Commissioner. I apologize. I'm
18 sorry for interrupting you.

19 DEPUTY COMMISSIONER MONTANEZ:

20 No. That's fine.

21 Like I said, we're more than
22 happy to come and have this discussion
23 with your office, if you want to see -- a
24 couple years ago Commissioner Williams
25 put out a report trying to see if we

1 3/10/22 - STREETS - RES. 220132
2 could get to the 131 miles of annual
3 paving. That would also put us into the
4 recommended paving cycles for asphalt.

5 You know, with roads that have
6 a certain ADT, average daily traffic, so
7 they carry truck traffic and all that,
8 for example, and John can chime in, the
9 state roads are somewhere in a five- to
10 seven-year cycle paving. The City tries
11 to maintain the arterials at somewhere
12 between 7 to 12, and then you will put
13 your, what we call, our residential
14 streets, low-volume streets, somewhere
15 between 20- and 30-year paving program.

16 COUNCILMAN THOMAS: Thank you.
17 Thank you. That's helpful. I appreciate
18 it.

19 Just two more questions. So
20 when we look at where we are as far as
21 some of the critiques that we've seen as
22 a city, looking at some of the issues
23 around the ratio of materials that we use
24 to treat roads and how and why we could
25 possibly adjust that, are there any

1 3/10/22 - STREETS - RES. 220132
2 thoughts on any type of adjustment on the
3 type of materials we use and the ratio
4 there?

5 MR. LORENZ: Deputy
6 Commissioner, if I can start off.

7 Again, Councilmember, again,
8 Steve Lorenz, Chief Highway Engineer for
9 the Streets Department.

10 I think the biggest challenge
11 we have is not so much the ratios of
12 chemical versus salt that we use. It's
13 just educating everybody as more salt is
14 not better. Okay?

15 We do use brine. Our
16 percentage is between 22 to 24 percent.
17 John Krafczyk from PennDOT testified it's
18 23 percent. So we're all in that same
19 amount. We do try to increase the amount
20 of brining we do.

21 COUNCILMAN THOMAS: Is your
22 recommendation that this is for
23 environmental purposes, this is the
24 safest way to go about this; is that
25 correct?

1 3/10/22 - STREETS - RES. 220132

2 MR. LORENZ: That is our
3 opinion on that, yes. Our goal is to
4 less salt -- more salt is not always
5 better. Again, it's harmful for the
6 environment. It's also not healthy for
7 the Water Department and how they treat
8 the water that's going back into our
9 drinking water.

10 So, you know, one is -- again,
11 I've been doing this for ten years,
12 overseeing the snow operations for the
13 City, and after most major snow events or
14 icing events, I'll talk to my colleagues
15 over in the Water Department and ask how
16 did we do with the spreading of the salt,
17 did we put too much down, did we put not
18 enough or whatnot, how is it affecting
19 their operation, and they'll come back to
20 me and, you know, layman's terms and say,
21 no, we did pretty good or, no, we have to
22 cut back on salt usage a little bit.

23 When I do talk to the Water
24 Department, they'll say -- and they've
25 got meters and sensors throughout the

1 3/10/22 - STREETS - RES. 220132

2 City where they do see an influx of salt
3 coming in. It's not so much for what the
4 Streets Department or the City is putting
5 out to the street. It's what's coming
6 upstream from some of the counties when
7 they're going a little bit heavier with
8 the salt.

9 Again, Philadelphia, you know,
10 with the Delaware River and the
11 Schuylkill River, Wissahickon and the
12 other water channels, we're at the
13 bottom. So everything up top feeds into
14 the water systems and comes down into the
15 City.

16 COUNCILMAN THOMAS: Thank you.
17 I'll stop right there.

18 I don't see any questions from
19 any of my colleagues teed up in the Chat
20 feature. So if there aren't any
21 questions from any of the members of this
22 Committee, I want to say thank you for
23 your presence here today. I want to say
24 thank you to your service to the City of
25 Philadelphia and all the great work

1 3/10/22 - STREETS - RES. 220132

2 you're doing. I understand that this is
3 a very complex issue. I'm still --

4 COUNCILWOMAN BASS:

5 Mr. Chairman?

6 COUNCILMAN THOMAS: I'm sorry.
7 The Chair recognizes Councilmember Bass.

8 COUNCILWOMAN BASS: My
9 apologies.

10 I just had a quick question in
11 listening to the testimony today, because
12 it's terribly disappointing that we are
13 about 100 miles under where we should be
14 in terms of paving per year, and I'm
15 wondering are we expecting any federal
16 resources through infrastructure dollars
17 or any other resources that could be used
18 to address some of the street issues that
19 we have? Because as the Chairman said,
20 it's really bad. And I know it's not --
21 that's not lost on you all. I know that
22 you all are very much aware of that.

23 DEPUTY COMMISSIONER MONTANEZ:
24 Councilmember, Richard Montanez, Deputy
25 Commissioner of Streets.

1 3/10/22 - STREETS - RES. 220132

2 We are looking at the IIJA to
3 see if there's any opportunities for us
4 to increase our paving funds utilizing
5 federal dollars. There has been a slight
6 increase on federal funds, but they're to
7 cover what we call the FAMS, the federal
8 aid maintenance highway system within the
9 City of Philadelphia. So you'll see an
10 increase on that.

11 I don't want to speak for John,
12 but PennDOT has also increased their
13 paving that they're planning to do this
14 year. They're going up to 45 miles of
15 state roads within the City of
16 Philadelphia. So you will be seeing an
17 increase whenever possible, and we're
18 hoping we can use some of that federal
19 funds to also do local roads.

20 COUNCILWOMAN BASS: Will you be
21 reporting them to the Chairman when you
22 have a better idea of what we can expect
23 from the federal side and what the impact
24 will be? So if you are able to do 45
25 additional miles per year or 55 or 100,

1 3/10/22 - STREETS - RES. 220132
2 whatever it is that we -- where we should
3 be, will you be reporting back to the
4 Chairman with that information so he can
5 share it with the Committee?

6 DEPUTY COMMISSIONER MONTANEZ:
7 As soon as we find out if there's federal
8 funds for local paving, yes, we can share
9 that.

10 COUNCILWOMAN BASS: That will
11 be great. Thank you very much.

12 COUNCILMAN THOMAS: Thank you.
13 You know, I'll add to that. I
14 think when we look at not just federal
15 dollars coming around infrastructure, but
16 also the state. The state has an
17 opportunity to use some of the surplus
18 dollars that they got from the federal
19 government to create initiatives, and I
20 think this is something that we should be
21 advocating for.

22 So as we prepare for budget
23 season, I'm definitely going to be
24 looking forward to our conversation,
25 first and foremost, around increasing the

1 3/10/22 - STREETS - RES. 220132

2 number of roads that's paved and the
3 amount of miles that we do per year from
4 18 to 35, if I'm understanding folks'
5 testimony today, but also looking forward
6 to hearing how and what we can do to put
7 us in a position to be able to get state
8 and federal resources to help get us
9 closer to a number that's realistic that
10 really addresses this issue, because this
11 is a crisis that feeds a lot of the other
12 problems that we're facing in the City,
13 and I know that you know that as well
14 too.

15 Are there any other questions
16 from members of this Committee for this
17 particular panel?

18 (No response.)

19 COUNCILMAN THOMAS: As we close
20 out and as we let you go, what I will say
21 is, again, as we continue to have this
22 conversation throughout budget season, I
23 think that you communicated concerns
24 around using the materials that you use
25 now versus exploring other materials.

1 3/10/22 - STREETS - RES. 220132

2 I'm not saying I necessarily agree with
3 everything that was said, but I do
4 completely understand your perspective
5 and what was communicated today, and I
6 hope that we can continue to explore
7 different options and methods, because I
8 think that you definitely explained the
9 infrastructure issues, and I understand
10 that side of it, but we're still
11 concerned with some of the issues around
12 our waters, storming issues,
13 environmental issues and things of that
14 capacity. So what other filters or what
15 other items can we put in place if this
16 is the method that we're going to
17 continue to use to put us in a position
18 to make sure that we're being as
19 environmentally friendly as possible.

20 So I do want to say thank you
21 to everybody in this panel for your
22 testimony today, and also I look forward
23 to working with you so we can continue to
24 brainstorm different options and methods
25 that we can use to make sure that we're

1 3/10/22 - STREETS - RES. 220132

2 being as environmentally friendly as
3 possible. So thank you, everybody.

4 DEPUTY COMMISSIONER MONTANEZ:
5 Thank you.

6 COUNCILMAN THOMAS: Madam
7 Clerk, would you please call the next
8 panel to testify on this bill.

9 THE CLERK: The first witness
10 for the second panel is Dr. John Jackson.

11 COUNCILMAN THOMAS: Thank you.
12 Please state your name,
13 Dr. Jackson. Please state your name for
14 the record and you may proceed with your
15 testimony.

16 DR. JACKSON: Good afternoon.
17 My name is John Jackson. I am a research
18 ecologist, stream ecologist, aquatic
19 entomologist at the Stroud Water Research
20 Center. I'm a Senior Research Scientist
21 there, and today my testimony is going to
22 be about my perspective of the salt
23 issue, and that perspective has been
24 developed over the last, say, 20 years.

25 I've had the good fortune of

1 3/10/22 - STREETS - RES. 220132

2 sampling over 400 sites in the Delaware
3 River Basin, and included in that are
4 also laboratory bioassays looking at salt
5 toxicity. I have also had the good
6 fortune at some of my sites to have
7 observed an increase in salt as part of
8 our environment. So whereas I recognize
9 there's drinking water issues, there's
10 infrastructure issues, those are not my
11 strength. My strength is really in the
12 environmental area.

13 The second thing as we get
14 started, it's important that while the
15 conversation is about Philadelphia, as
16 was noted earlier, the water issue in the
17 streams and rivers of Philadelphia are a
18 regional problem. The issue of increased
19 salt in our waterways is not just a
20 Southeast Pennsylvania region problem.
21 It really extends from North Dakota all
22 the way down to Virginia, and it's really
23 tied to the use of road salt primarily
24 and especially in this area.

25 So, overall, salt in our

1 3/10/22 - STREETS - RES. 220132

2 streams has been increasing. We've known
3 about that for about 20 to 30 years. I
4 first observed it in my own data about
5 2005, somewhere in there. Right now our
6 concentrations in our streams are
7 anywhere from commonly 10 to 100 times
8 normal or original. So go back to, say,
9 1940 before we started deicing. And in
10 some places, we're observing
11 concentrations that are 1,000 or 10,000
12 times what you would have seen in 1940,
13 and most of this, again, as I said, seems
14 to be tied to road salt use.

15 So it's not a problem, though,
16 that is well regulated, because when the
17 Clean Water Act was passed, the increases
18 were already apparent in the data we had,
19 but we really weren't aware of it. We
20 weren't analyzing for it.

21 But at this point, it's
22 continued to increase. So we're 50 years
23 past passing the Clean Water Act and
24 we're looking at salt concentrations now
25 that are toxic at some times and at some

1 3/10/22 - STREETS - RES. 220132

2 locations. That's true both in the
3 winter when we see our highest
4 concentrations, but also in the summer.
5 And we see summer salt concentrations
6 still being elevated, because every year
7 we're continuing to contaminate the
8 groundwater, because every winter, we'll
9 infiltrate some of that stormwater, some
10 of that snow melt that's contaminated
11 with road salt into the groundwater, and
12 then that comes out as stream water
13 during the summer.

14 As has also been noted, there's
15 lots of people that are responsible. You
16 had two of the parties that are commonly
17 included when, say, in Wisconsin or
18 Minnesota they've looked at budgets for
19 salt for a whole watershed. That's the
20 state and municipalities, but private
21 applicators are big players in this
22 conversation. And I would encourage
23 you -- this is a challenge for us, but I
24 would encourage you to look at this also
25 as a source. In a budget, they might be

1 3/10/22 - STREETS - RES. 220132
2 20 to 40 percent of total salt going into
3 the waterway.

4 The proportions vary depending
5 on the road, distribution of roads, who
6 is responsible, state, municipal, private
7 roads, parking lots.

8 From my perspective, there's no
9 easy solution. It's a regional problem.
10 Municipalities are going to have to work
11 together. It was noted earlier, whether
12 it's the Wissahickon or the Pennypack or
13 the Tookany/Tacony-Frankford, all of
14 these watersheds start outside of
15 Philadelphia and then come into
16 Philadelphia, the City and County of
17 Philadelphia. So it's really going to be
18 a conversation between people.

19 The other thing is, there's
20 really no easy solutions. We have to
21 reduce the salt. If we don't, we're just
22 going to see it increasing. It will
23 continue to increase, just as it has for
24 the last 50 to 70 years, and that means
25 the environmental costs, the

1 3/10/22 - STREETS - RES. 220132
2 infrastructure costs, private property
3 damage, drinking water challenges.
4 They're all also going to increase.

5 So it's going to be just a
6 general decrease in salt use. And when I
7 say "salt," I mean all sources, not just
8 rock salt, but brine is just, in my
9 perspective, salt. And the beet juice
10 treatments are, from my perspective,
11 primarily just salt.

12 There are good examples out
13 there. I would encourage you to look for
14 them, out of New York, out of Maryland
15 where significant reductions in salt
16 applications have occurred, but the
17 perspective, of course, it's challenging
18 to interpret their -- their results is
19 where did they start.

20 So we're all part of the
21 problem and we're all part of the
22 solution. The use of salt is something
23 we ask for. Those of us who were around
24 in the '80s and '90s know what those
25 storms did and what people asked for, but

1 3/10/22 - STREETS - RES. 220132

2 we never had a balanced discussion. We
3 didn't recognize the hidden costs. Now
4 we do. We're seeing them. So now we
5 have to revisit that conversation.

6 That concludes my testimony.

7 Thank you.

8 COUNCILMAN THOMAS: Thank you
9 for your testimony. We appreciate it.

10 Madam Clerk, will you please
11 call the next witness for this panel.

12 THE CLERK: The next witness is
13 Geoffrey Selling.

14 COUNCILMAN THOMAS: Thank you.

15 Please state your name for the
16 record and you may begin with your
17 testimony.

18 (No response.)

19 COUNCILMAN THOMAS: Madam
20 Clerk, are we struggling?

21 THE CLERK: He was connected
22 earlier. We can move on and come back to
23 him then.

24 COUNCILMAN THOMAS: Sure.

25 Please call the next panel.

1 3/10/22 - STREETS - RES. 220132

2 THE CLERK: The next witness is
3 Dr. Laura Toran.

4 Dr. Toran, are you connected?

5 DR. TORAN: I'm sorry. Can you
6 hear me?

7 THE CLERK: Thank you.

8 DR. TORAN: Okay. I'm a
9 professor at Temple University and I
10 specialize in urban hydrology, and I want
11 to thank Councilperson Thomas for
12 initiating this hearing on the
13 application of road salts in our City
14 streets.

15 So, as I said, my research is
16 in urban hydrology. It involves sampling
17 our local streams. So my field areas are
18 the Wissahickon, the Pennypack, the
19 Tookany, to some extent the Cobbs. Some
20 of these streams I have been sampling for
21 more than 15 years and I have watched the
22 salt concentrations steadily rise. John
23 talked about the 1940's to now timeframe,
24 but I'm seeing it creep up over just the
25 most recent years. So we are continuing

1 3/10/22 - STREETS - RES. 220132

2 to add to the problem. Whatever we're
3 doing to mitigate isn't quite working
4 yet.

5 It's a slow creep, so you might
6 not notice if you just compare one year
7 to another, because there's a lot of
8 variability. We know it snows different
9 amounts different years, but if you look
10 over the long term, the trend just is
11 inextricably upward.

12 I get my data from a couple of
13 different sources. We do quarterly
14 sampling with our watershed organizations
15 who have been funded by the William Penn
16 Foundation for the past eight years. I
17 also review data from the U.S.
18 Geological Survey and the Philadelphia
19 Water Department stream gauges where they
20 measure stream conductivity continuously.
21 Stream conductivity is directly related
22 to road salt, and it provides some really
23 good long-term datasets.

24 So these data show that the
25 salt concentrations are creeping up from

3/10/22 - STREETS - RES. 220132

maybe 50 milligrams per liter back in the '70s, 100 milligrams or so a decade ago, and now creeping up to 150, 200. In the Wissahickon and Cobbs, I see locations that are over 200 milligrams per liter on average.

Now, this is an annual average. So that means in the winter, the concentrations can rise even larger, as John mentioned. We get peaks over 1,000 milligrams per liter sometimes, and the natural concentrations within an area with no human influence should be more like 10 or 20 milligrams per liter. And road salt is the obvious culprit.

Let's look some place where they don't use road salt very much. Fort Indiantown Gap in Central Pennsylvania is a military base. They drive around in Humvees. They don't need to salt their roads on the base itself. There when I compare the 1970's to now, it was around 5 or 10 milligrams per liter. It's maybe 10 or 20 now. They're remaining below

1 3/10/22 - STREETS - RES. 220132

2 dangerous levels because they aren't
3 applying road salt.

4 Now, another thing the numbers
5 tell us, as John again mentioned, is that
6 this is all year long. It's not just in
7 the winter. The salt isn't just getting
8 into the groundwater. It's stored in the
9 soil as it travels on its way to the
10 stream, and we don't see enough fresh
11 water clearing out that saltwater in the
12 spring and summer.

13 I monitor stormwater basins in
14 the region for that William Penn
15 Foundation grant, and we put sensors in
16 some stormwater basins and found that the
17 salt was there in the winter of 19 --
18 last winter, 2021, and it didn't flush
19 out until around June.

20 So the soil in that basin was
21 very permeable. It's not your typical
22 urban soil that drains slowly, and even
23 that wouldn't flush out.

24 These pockets lead to very
25 large supply of salt in our streams all

1 3/10/22 - STREETS - RES. 220132

2 year long.

3 So John mentioned that there's
4 studies that show that the salt has
5 detrimental impacts on aquatic life in
6 the streams. The EPA recommends that we
7 keep salt below 250 milligrams per liter
8 and peak concentrations less than 840.
9 We've already seen those levels in some
10 of our streams.

11 Another problem is that salt
12 mobilizes trace metals, which can also
13 impair aquatic life. In addition,
14 Philadelphia's Green Streets program is
15 endangered by salt runoff. Stormwater
16 basins work better when they have plants
17 to increase infiltration, but the salt in
18 the stormwater kills many of the plants
19 used in these basins.

20 So this is a widespread problem
21 in our area, around the nation, and
22 around the world, and it's not going to
23 go away on its own. It's, as I said,
24 inextricably creeping upward. And it
25 isn't easy to predict where you're going

1 3/10/22 - STREETS - RES. 220132
2 to see the problem, so we need to develop
3 a more widespread solution.

4 I think cities can be the
5 people that look for those solutions and
6 then teach the businesses and the public
7 what they can do better. So we can be a
8 real role model if we can figure this
9 out.

10 So I encourage you to keep
11 working on this problem, and I really
12 thank you for discussing the strategies
13 to try to improve the environmental
14 damage that's heading our way.

15 Thank you very much.

16 COUNCILMAN THOMAS: Thank you
17 for your testimony. I appreciate it.

18 I don't see any questions from
19 members of the Committee in the Chat
20 feature. I'll just ask one, and this is
21 for both members of the panel.

22 Based on your perspective and
23 your expert experience as well as the
24 testimony that we heard prior to you,
25 clearly there's conflicting interests.

1 3/10/22 - STREETS - RES. 220132

2 What would you recommend to the City of
3 Philadelphia as it relates to how we
4 should move forward? Clearly they feel
5 like the chemical balance that they're
6 using right now, the ratio of salt and
7 how they're doing things, is the best and
8 most environmentally safe way to do it,
9 but on the contrary, we're hearing you as
10 experts testify that what we're doing is
11 not necessarily best.

12 So if you were completely in
13 charge of the work that's being done in
14 the City of Philadelphia as it relates to
15 this particular issue, how would you
16 recommend that we best deal with these
17 storms and prepare for these storms?

18 DR. TORAN: I'll take a first
19 cut at it, but I certainly want to hear
20 from John too.

21 I don't -- I think John already
22 said that this is a really tough problem
23 to solve. I think communication is one
24 thing, that if Philadelphia thinks
25 they're doing the right thing, start

1 3/10/22 - STREETS - RES. 220132
2 educating some of the businesses and
3 maybe the suburbs. I see differences in
4 how much salt are in different streams in
5 the suburbs. So some of the suburbs are
6 applying more salt than others. So
7 communication is something that might --
8 you know, more widespread communication
9 about proper ways to do things.

10 Keep your eye -- I know there's
11 computers that help you control how much
12 brine you put down. Keeping your eye out
13 on new innovations like that, maybe even
14 looking at vegetation that might help
15 take up salt so that on the edges of
16 roads you've got a barrier between the
17 road and when it gets into the soil and
18 the others. Some plants don't like salt,
19 but there's some that really like it and
20 might take it up.

21 I would just keep your eye on
22 the ball for those new solutions that are
23 coming down, and as soon as you find
24 them, let all of the other communities
25 and the businesses, especially the

1 3/10/22 - STREETS - RES. 220132

2 businesses, know that there's a better
3 way to do things.

4 John, anything to add to that?

5 DR. JACKSON: No. I really
6 like targeting the private people, and
7 it's the private applicators have the
8 least training, have the equipment that's
9 least easily controlled, and they also
10 have significant liability issues that
11 I've only seen well addressed in other
12 states like New Hampshire, where they
13 have a certification program, and that
14 might be a partnership with the state for
15 our region to help develop something like
16 that.

17 The best example that I've
18 seen -- so I think the state and the
19 municipal people are best educated,
20 probably state first, state and federal
21 types of things. They have the best
22 training and the best equipment. And
23 it's a trickle down.

24 There are some examples in my
25 written testimony. I included some

1 3/10/22 - STREETS - RES. 220132
2 links. I like what Maryland is doing.
3 They reduced their road salt use by 50
4 percent across very variable weather,
5 from snowy mountains down to coastal iced
6 areas, and they did it through aggressive
7 brining. And brining is less salt than
8 rock salt, because remember, it's only
9 23 percent salt.

10 The other thing is, the guys in
11 New York, they swear by Live Edge snow
12 blades or a snow blade that adjusts to a
13 variable or irregular road surface, and
14 if you think about Philadelphia streets,
15 that's an issue that we have. Older
16 streets are not real flat, and the Live
17 Edge is helpful there.

18 But I think we can learn from
19 others. They're ahead of us right now.
20 What I haven't found out is how -- who to
21 recommend for that training. I just
22 haven't found the links. They seem to be
23 doing it inhouse, training themselves.

24 COUNCILMAN THOMAS: Thank you.
25 Very good insight, very good information,

1 3/10/22 - STREETS - RES. 220132

2 and as we continue to explore this issue,
3 we are hoping that we can tap both of you
4 as a resource to help us think through
5 this complex problem that we're facing
6 right now.

7 So thank you. Thank you so
8 much for your perspective. Thank you for
9 taking time.

10 Are there any other questions
11 for members of this Committee for this
12 particular panel?

13 (No response.)

14 COUNCILMAN THOMAS: Seeing and
15 hearing none, I want to again say thank
16 you so much for being here with us today
17 and for providing your expert opinion.
18 It's greatly appreciated.

19 Madam Clerk, would you please
20 call the next panel of witnesses to
21 testify on this bill.

22 THE CLERK: The first witness
23 for the next panel is Geoffrey Selling.

24 Geoffrey, are you connected?

25 MR. SELLING: I am. Can you

1 3/10/22 - STREETS - RES. 220132

2 hear me?

3 COUNCILMAN THOMAS: We can hear
4 you. Please state your name for the
5 record and you may begin with your
6 testimony.

7 MR. SELLING: My name is
8 Geoffrey Selling.

9 Good afternoon, Councilman
10 Thomas and members of the Streets and
11 Services Committee. As I said, my name
12 is Geoffrey Selling. I live in the Mount
13 Airy section of Philadelphia and I'm a
14 retired science teacher from the
15 Germantown Friends School. In my
16 retirement, I volunteer as a Master
17 Watershed Steward with the Penn State
18 Extension, as a Streamkeeper with the
19 Tookany/Tacony-Frankford Watershed
20 partnership, as a weekly volunteer
21 working to improve Rock Creek in Curtis
22 Arboretum just outside of Philadelphia,
23 and finally as a volunteer chloride
24 monitor with the Izaak Walton League's
25 Winter Salt Watch Program, which recently

1 3/10/22 - STREETS - RES. 220132
2 named my partner and myself Salt Monitors
3 of the Month. My testimony is based on
4 my roles as a watershed steward, a
5 streamkeeper, and a salt watch monitor.

6 Each month my partner, Chris
7 Peterson, and I test the waters in Rock
8 Creek for salt levels. We have done this
9 for several years. Initially we tested
10 the levels just in the winter, but when
11 they didn't go down last year, we
12 continued to test monthly right through
13 the seasons, only to discover that the
14 chloride levels in Rock Creek were still
15 and are still shockingly high both in
16 winter and summer.

17 Some of the salt tests we
18 performed actually exceeded the highest
19 levels on our charts and now require us
20 to use different and specialized testing
21 protocols.

22 So much salt has being dumped
23 on the roads, and brine I might add, and
24 sidewalks and parking lots that when it
25 rains, all that extra salt goes down into

3/10/22 - STREETS - RES. 220132

our creeks. We also learned that other salt monitors in the Delaware Valley on other creeks throughout this greater metropolitan Philadelphia area were finding the same thing as we have, that the salt levels were so high that salt was actually getting into our groundwater and keeping the chloride levels high in our creeks year round.

At times, our streams are as salty as the ocean. In the winter, salt levels in creeks we monitor are 50 to 100 times higher than normal, as Dr. Jackson said. In the summer, they're 10 to 30 times higher than a normal healthy stream.

In the watershed through which Rock Creek flows, municipalities are spreading about 220,000 pounds of salt annually, whether in the form of rock salt or brine. Much of it ends up in creeks when the snow and ice melt and then the rain washes the residue down off the roads.

1 3/10/22 - STREETS - RES. 220132

2 Salty streams harm wildlife and
3 the riparian plants that cannot survive
4 in chloride-laced water. These elevated
5 levels of chloride affect things such as
6 fish and amphibians that rely on our
7 creeks, as well as the aquatic insects
8 known as macro-invertebrates that live on
9 the bottoms of our creeks.

10 Macro-invertebrates are juvenile insects
11 that provide food for fish and, when they
12 hatch out as adults, are a major source
13 of food for our area bird population,
14 including our beloved songbirds like
15 robins, warblers, and finches.

16 Salt also is not removed in our
17 city drinking water plants. Since our
18 creeks all end up in the Schuylkill and
19 Delaware Rivers and those rivers supply
20 our drinking water, something that many
21 Philadelphians don't understand, this
22 means that our citizens are drinking and
23 using water high in chlorides, which is a
24 major factor in high blood pressure and
25 in heart disease. Elevated chloride

1 3/10/22 - STREETS - RES. 220132

2 levels can affect people who have health
3 concerns related to salt intake.

4 Additionally, as has been
5 mentioned, salt is corrosive to pipes,
6 faucets, sinks, and appliances in both
7 businesses and homes, causing enormous
8 damage that takes place slowly and
9 insidiously. Roads, bridges, cars are
10 all affected by this heavy salting, and
11 we all pay for the repairs.

12 Most all of our creeks in this
13 area are impaired, some seriously. Salt
14 is one of our major impairments.

15 We've talked a little about
16 where the salt is coming from, but I want
17 to review because there's a few things I
18 wish to add. Obviously there are the
19 major highways and the major roadways
20 that are salted or brined by PennDOT. I
21 won't say more about that. It's been
22 covered. The City and suburban streets
23 are salted by our Streets Department or
24 by the various townships and street
25 departments in the counties. Often there

1 3/10/22 - STREETS - RES. 220132

2 is very sloppy application. In my
3 written testimony, which I will be
4 submitting, are photographs of huge salt
5 spills in Philadelphia, one taken right
6 on the Ben Franklin Parkway and in my own
7 neighborhood of Mount Airy. So please do
8 look at the testimony, the written
9 testimony. You'll see those actual
10 photographs.

11 There's also a problem of
12 over-application. Salt is often
13 overapplied on the mistake and assumption
14 that a road with a thick crunchy
15 application of salt will somehow be safer
16 than a street with less salt. There are
17 standards from the Wisconsin Department
18 of Natural Resources for correct amounts
19 of salt and, more importantly, there are
20 actually trainings for salt applicators.
21 So I am including the link for that in my
22 testimony, in the written testimony,
23 because that might be something that our
24 PennDOT and our Streets Department can
25 look into, those online trainings.

1 3/10/22 - STREETS - RES. 220132

2 A third problem, as Dr. Jackson
3 mentioned, are parking lots of retail
4 establishments, especially those big box
5 store complexes and shopping centers.
6 These establishments are often on rented
7 property managed by absent landlords, who
8 simply pay salt applicators to put on
9 lots of salt. Again, many people
10 mistakenly equate lots of crunchy salt as
11 making those parking lots safer, but it
12 doesn't. Again, refer to the trainings
13 for applicators from Wisconsin Department
14 of Natural Resources.

15 A small amount of salt can go a
16 long way, and crunchy parking lots are
17 not safer. I recently watched a salt
18 truck in one of the suburban parking lots
19 as it came to each lane's end, it stopped
20 because there were cars going by, but the
21 application machine kept going. So at
22 the end of each lane were enormous piles
23 of salt as it went up and down each
24 supermarket lane.

25 Then there are the homeowners.

3/10/22 - STREETS - RES. 220132

Homeowners often apply salt on snow instead of shoveling and they overlap salt on sidewalks. The average Philadelphia homeowner can make their icy sidewalk safe with just one coffee mug full of salt rather than quarts and quarts of it. Moreover, few homeowners clean up extra salt debris after the storms. There needs to be a widespread education program.

I would be remiss if I didn't mention the burgeoning perception among many Philadelphians and suburbanites that even with heavy snow, our roads ought to be almost instantly passable with our vehicles going at normal speeds. If our streets aren't instantly plowed and heavily salted, many citizens grumble that the Streets Department is incompetent and our tax dollars are being wasted. A citywide education program is needed to help our citizens understand the impact of that perception and how the increasing pressure on the City is

1 3/10/22 - STREETS - RES. 220132
2 harming our streams, our wildlife, our
3 health, and our infrastructure.

4 So thank you very much for
5 holding this hearing, and I invite you
6 all to look at the photographs in my
7 written testimony, because I think
8 they're quite compelling.

9 Thank you again.

10 COUNCILMAN THOMAS: Thank you.
11 Thank you for your testimony and for the
12 detailed information. It's very much
13 appreciated, including the links. So we
14 appreciate it, and we will definitely
15 check it out.

16 Madam Clerk, can you please
17 call the next witness for this particular
18 panel.

19 THE CLERK: The next witness is
20 Dr. Jerry Klein.

21 DR. KLEIN: Hello. I'm
22 Dr. Jerry Klein. I live in Chicago,
23 Illinois. I'm a veterinarian. I'm here,
24 Office of the Chief Veterinary Officer
25 for the American Kennel Club, but prior

1 3/10/22 - STREETS - RES. 220132

2 to that, I was an emergency veterinarian
3 for 35 years, culminating in department
4 head of the emergency department. So
5 35 years of Chicago means 35 years of
6 Chicago winters.

7 I saw many emergencies. Our
8 specialty and emergency centers saw about
9 11,000 patients per year.

10 But I also am a dog owner
11 living in Chicago in the city. So I
12 experience individually what's going on
13 with my dogs, but also take care of other
14 dogs as well. And to be truthful, it's
15 an emergency -- there's medical issues
16 and there are medical emergencies, and I
17 think deicers can cause one or the other
18 depending on why. And all deicers are
19 comprised of salt, so sodium chloride,
20 potassium chloride, magnesium chloride,
21 and calcium chloride often or calcium
22 carbonate, and they all can be dangerous
23 if they're ingested, but the majority of
24 dogs don't ingest these in any large
25 amounts. They usually do it incidentally

1 3/10/22 - STREETS - RES. 220132

2 because they lick their paws after being
3 walked in these sidewalks often times,
4 and urban dogs are usually walked either
5 on sidewalks or alleys, and of course
6 they may have to cross the street as
7 well.

8 So the most common problem that
9 I found with dogs are usually not medical
10 emergencies. Medical issues, even my own
11 dogs, is contact irritation from the salt
12 on the pads of their feet, usually
13 manifesting in red paws. They may become
14 lame or lift their paws up. It's usually
15 rectified by rinsing the paws off when
16 you get home or wiping things off clear
17 or having dogs wear booties, which used
18 to be almost non-existent, but now many
19 people in the City are using it. Also,
20 the weather seems to be getting colder.

21 But the number of dogs actually
22 getting gastrointestinal issues and
23 toxicities is much less. They have --
24 every dog is individualized, more so than
25 people because of the great range in

3/10/22 - STREETS - RES. 220132

size, from a Chihuahua to a Great Dane. So the amount ingested is dependent upon the dog's size. So if a Shih Tzu or Chihuahua ingests a certain amount off their paws, they may vomit or have vomiting and diarrhea, often times resolving on its own but sometimes requiring medical help to rectify the gastrointestinal upset.

However, there are the rare occurrences where a dog will get into a bag of salt, and that will cause much more serious issues. To be truthful, in my 35 years, I've had less than a handful of dogs that have done that, I think all of them Labradors, because they seem to -- salt is not palatable to most dogs, but some dogs do.

So I think in the City, it's very dependent upon -- you may do certain things for your own home, but your next-door neighbor or three doors down may do something very differently. So an individual dog is subject to different

1 3/10/22 - STREETS - RES. 220132

2 types of deicer material in any one walk,
3 and how it affects the dog can be very
4 individualized.

5 But I think the good news is to
6 be truly toxic to a dog, they would have
7 to eat a huge amount of deicer proportion
8 to their body weight to become truly ill.
9 That doesn't mean that things can't be
10 done to be better, but I think that's my
11 experience with that here in Chicago.

12 That concludes my testimony.

13 COUNCILMAN THOMAS: Thank you.
14 Thank you for your testimony. It's
15 appreciated.

16 Madam Clerk, will you please
17 call the next witness for this panel.

18 THE CLERK: The next witness is
19 Stephanie Wein.

20 MS. WEIN: Hi, everybody. My
21 name is Stephanie Wein and I'm the Clean
22 Water and Conservation Advocate for Penn
23 Environment, and in my capacity at Penn
24 Environment, I work on our programs to
25 ensure that Pennsylvanians have access to

1 3/10/22 - STREETS - RES. 220132
2 clean water from stream to tap. So thank
3 you for inviting our testimony.

4 So Penn Environment and the
5 members we represent throughout the City
6 of Philadelphia have a vested interest in
7 healthy streams in our city, and we
8 simply can't have healthy streams with
9 the level of salt we already use. So we
10 support improvements to street salting
11 operations that allow us to reduce the
12 salt on our streets, sidewalks, and
13 parking lots.

14 The salt that we apply to our
15 roads during winter storm events washes
16 into our storm drains and off our roads
17 into the City's creeks and rivers, as I
18 think we've well established. And while
19 the Streets Department has been more
20 mindful of salt overuse in recent years,
21 salt levels, as Jeff shared, on our urban
22 waterways following winter storms can
23 exceed the salinity of the ocean. And
24 the plants and animals that live in our
25 city streams, from the Pennypack to the

1 3/10/22 - STREETS - RES. 220132
2 Wissahickon to the Schuylkill River,
3 they're adapted for fresh water, and so
4 when pulses of salt flood our waterways,
5 the results for our city's aquatic
6 wildlife are disastrous.

7 And even when salt
8 concentrations aren't immediately lethal,
9 the increased salinity we're seeing has
10 long-term impacts on aquatic life. So
11 for amphibians, it disrupts the
12 development of their eggs into tadpoles
13 and it depresses their immune response to
14 pathogens, leaving populations of our
15 frogs and salamanders more vulnerable to
16 the numerous novel diseases that are
17 already threatening amphibian
18 populations.

19 And even brief pulses of highly
20 elevated salt levels can have
21 irreversible impacts on the growth and
22 development of eggs and tadpoles. And
23 similar impacts have also been observed
24 in the growth and development of fish
25 eggs and of larvae. And salt also

1 3/10/22 - STREETS - RES. 220132
2 decreases the number of insects in our
3 streams, which compromises the base of
4 the food webs in our urban forests like
5 the Wissahickon, feeding animals we love
6 to see like songbirds.

7 And so as the experts before me
8 have shared, the salt also lingers, not
9 just right after the winter storm events
10 but it lingers in the ground and it
11 releases into the streams in the spring
12 and summer months, and that provides an
13 unhealthy high salt condition year round,
14 which is an ongoing stress for aquatic
15 wildlife who don't get a break from that
16 high salt environment.

17 And the impacts, though, for
18 the wildlife go beyond the streams
19 themselves. When salt washes off roads
20 into ditches, into front yards, into
21 gardens, into parks, it increases the
22 salinity of the soil nearby. That limits
23 what plants grow. And so with more salt,
24 we see less plant diversity in our
25 curbsides, which is a particular shame

1 3/10/22 - STREETS - RES. 220132

2 when Philadelphia is working to lead on
3 green infrastructure through our Green
4 Cities, Clean Water Program. A lot of
5 that relies on healthy plant communities
6 right alongside our roadways. And the
7 plants that are able to grow will
8 actually concentrate increased sodium in
9 their leaves. So the same plant will
10 have more salt, and that can cause salt
11 toxicity for the animals that eat those
12 plants.

13 And so, for example, the
14 monarch butterfly, which depends on the
15 milkweed plants that many environmentally
16 minded Philadelphians are faithfully
17 planting in their gardens, they can
18 experience higher mortality when they
19 consume too much salt from eating higher
20 salt milkweed.

21 And then what we do on our city
22 streets obviously does ultimately end up
23 in the Delaware River, which we and other
24 municipalities rely on for drinking
25 water, as has been said. There we see

1 3/10/22 - STREETS - RES. 220132
2 the over-salting impact on human health.

3 And so over the last three
4 decades, increased road salt in American
5 rivers has impacted drinking water. The
6 USGS has found an increasing number of
7 public drinking water with salt
8 concentrations above the EPA safe
9 threshold, which, of course, poses a
10 health risk to people with heart
11 conditions or blood pressure that are
12 trying to control their salt intake.

13 But beyond that, the increased
14 chloride from the road salt also
15 increases corrosion in our pipes, and as
16 a city with as many lead pipes
17 Philadelphia has, this can lead to
18 increased lead leaching into the drinking
19 water. We need to be doing all that we
20 can to limit the risk of lead leaching
21 into Philadelphia's pipes, and that
22 includes protecting our source water,
23 which includes addressing road salt.

24 In Philadelphia, we are
25 uniquely blessed amongst major cities

1 3/10/22 - STREETS - RES. 220132
2 with our urban green space and with our
3 beloved streams like the Wissahickon and
4 the Poquessing and the Tookany, but to
5 keep our natural spaces and ourselves
6 healthy, I'm just encouraging our
7 rethinking of our approach to road salt,
8 and as noted by other experts, there are
9 a lot of solutions.

10 First, we care about safety,
11 which we get by increasing traction, and
12 there are ways to do that without
13 deicing. So earlier and frequent plowing
14 and the use of the best blade technology
15 can decrease the use -- the need for
16 salt. And sand and other mineral spreads
17 can create traction and reduce slipping
18 on our roads and sidewalks and parking
19 lots. But I think the most important
20 takeaway from us as an environmental
21 group is just the need for less salt. As
22 many have said, more is not better.

23 Northeastern cities are
24 developing (connection issues) salt
25 application to maximize efficiency, and

1 3/10/22 - STREETS - RES. 220132

2 we should look to their leadership. And
3 this, of course, includes, as has been
4 said, brine application, and that can
5 include additives that increase efficacy.

6 While beet juice has been shown
7 to reduce the amount of necessary salt
8 and increase the efficacy of those lowest
9 of temperatures, these solutions are
10 still highly saline, and a lot of
11 additional additives like calcium
12 chloride, they aren't without their own
13 environmental impact. So when we decide
14 to use brine, we still need to be mindful
15 of overuse, and we shouldn't think of
16 that as something that is somehow
17 different from salt.

18 For beet juice, the pulse of
19 organic material and of nutrients into
20 our waterways that comes from beet runoff
21 can cause algal blooms. That reduces
22 oxygen available in our waterways and
23 that can make our streams inhospitable
24 for fish and insects. And then magnesium
25 and calcium chlorides might reduce the

1 3/10/22 - STREETS - RES. 220132
2 impact of how much sodium is ending up in
3 the water, but these salts still contain
4 chlorides. That can have that same
5 impact of lowering the pH and have the
6 aforementioned impact of corrosivity and
7 lead leaching in our drinking water
8 supply.

9 And while this may be beyond
10 the scope of this hearing, as some of the
11 other testifiers have noted, how much
12 salt is applied by private property
13 owners, I challenge the City to find a
14 way to address this holistically, and we
15 also need to work collaboratively with
16 our upstream neighbors in the collar
17 counties to reduce their own salt,
18 because as we work to get our salt house
19 in order, we are still a downstream
20 community, and so we need to make sure
21 that we're working with our neighbors to
22 make sure there's less salt in our
23 streets and, therefore, less in our
24 waterways.

25 Thanks for the opportunity to

1 3/10/22 - STREETS - RES. 220132

2 testify, and Penn Environment is happy to
3 be a resource to Council on the impact of
4 over-salting on Philadelphia's
5 environment.

6 COUNCILMAN THOMAS: Thank you,
7 and thank you for all the work you do. I
8 think that a couple things really stuck
9 with me. I think you gave us some
10 phenomenal information and facts. I
11 think my heart kind of went out to the
12 pets just thinking about all the
13 different animals across the City.
14 Philly is like one of those cities that
15 has unique DNA, and I think we're a pet
16 city. People really love their pets in
17 Philadelphia. And to know that this is
18 something that continues to damage
19 animals and pets in the City outside of
20 those who are in the water is something
21 that's alarming, but then also just
22 considering and thinking about what we're
23 doing as a city and the impact that the
24 decisions that businesses make and how
25 they decide to preserve land and spaces

1 3/10/22 - STREETS - RES. 220132

2 in their area when a storm hits is a
3 significant problem as well.

4 I would love to move into a
5 space and a place where we're relying on
6 more street pavement when these storms
7 hit, but we know far too often that the
8 City is not capable of paving all the
9 streets across the City, and far too
10 often poor communities and communities of
11 color are the ones who get left out and
12 they end up stuck on their block and
13 dealing with ice and snow for days at a
14 time after a really bad storm.

15 So I think that we have a lot
16 of work to do. This panel was really
17 good. You guys gave us some great
18 information and a lot of things that we
19 really have to think about and
20 contemplate as we figure out what
21 direction we go in as a city, as well as
22 how we provide information to not just
23 our businesses but also our private
24 partners.

25 So thank you. Thank you to

1 3/10/22 - STREETS - RES. 220132

2 this panel.

3 Are there any members of
4 Council who have any questions for this
5 particular panel?

6 (No response.)

7 COUNCILMAN THOMAS: Madam
8 Clerk, are there any other members of
9 this panel to testify?

10 THE CLERK: Yes. We have two
11 more witnesses to testify.

12 COUNCILMAN THOMAS: Okay. I'm
13 sorry. I was a little excited. If we
14 could go ahead and let our next two
15 witnesses testify, that would definitely
16 greatly be appreciated.

17 THE CLERK: Absolutely.
18 The next witness is Samantha
19 Briggs.

20 COUNCILMAN THOMAS: Please
21 state your name for the record and you
22 may begin with your testimony.

23 MS. BRIGGS: Hi there. Thank
24 you, Councilmember Thomas. My name is
25 Samantha Briggs and I am the Clean Water

3/10/22 - STREETS - RES. 220132

Program Director at the Izaak Walton League. The Izaak Walton League of America is a national member-based organization. We're a conservation organization with a mission to conserve, restore, and promote the sustainable use and enjoyment of our natural resources, including soil, air, woods, waters, and wildlife.

The League has a longstanding history of advocating for clean water, most notably with our Save Our Streams program created over 50 years ago. Over the past half century, Save Our Streams has evolved to meet the challenges of modern water quality problems such as road salt pollution. In 2018 after a large salt spill outside of League headquarters in Maryland left Muddy Branch stream with toxic levels of salt runoff, League staff launched Salt Watch, a crowdsourced monitoring program that equips volunteers with free test strips to sample the waterways in their

1 3/10/22 - STREETS - RES. 220132
2 community for road salt or chloride
3 pollution.

4 The Salt Watch data from each
5 collection site is loaded into a national
6 database, which is available to
7 researchers, the public, and
8 policymakers. The Izaak Walton League
9 hopes that robust data collection over
10 successive years will help establish
11 reliable baseline information and
12 pinpoint pollution problems so local
13 authorities can address road salt
14 problems and adopt better practices.

15 Last winter, volunteers from
16 the Philadelphia metro region submitted
17 over 275 test results. Forty-four
18 percent of the results submitted from
19 September to May yielded high readings,
20 over 100 parts per million chloride, and
21 over half of those high readings were at
22 toxic levels, over 230 parts per million.
23 There were more than three times as many
24 results in the 2020 to 2021 winter season
25 as the previous year around Philadelphia.

1 3/10/22 - STREETS - RES. 220132

2 With more volunteers than ever keeping an
3 eye on road salt pollution, there is more
4 data to confirm that salt is a
5 significant water pollution issue that
6 can harm aquatic life and drinking water
7 for years after the salt hits the road.

8 Ideally, freshwater lakes and
9 streams should have low to no salt
10 content. Levels above 100 parts per
11 million exceed naturally occurring
12 concentrations of salt. According to the
13 EPA, concentrations above 230 parts per
14 million are toxic to aquatic life with
15 prolonged exposure.

16 Excess salt in drinking water
17 can be a problem for people with high
18 blood pressure and other health
19 conditions that require a low sodium
20 diet, since water filtration plants are
21 not equipped to filter out excess salt.

22 Even more alarming is the fact
23 that excess salt is corrosive to
24 infrastructure, which can leach lead and
25 other heavy metals from pipes that can

1 3/10/22 - STREETS - RES. 220132

2 result in a public health crisis similar
3 to the Flint water crisis.

4 While road salt can improve
5 driving safety during icy conditions, the
6 salt eventually washes into watersheds
7 where it damages the quality of drinking
8 water and harms aquatic life in
9 freshwater streams and lakes. More than
10 100 million Americans depend on local
11 streams for drinking water, but the water
12 treatment plants are not equipped to
13 filter out excess salt.

14 The Izaak Walton League created
15 Winter Salt Watch to give volunteers the
16 tools to identify excess road salt in
17 streams and other waterways. The program
18 aims to ensure transportation safety
19 while protecting clean water through best
20 practices, including, number one,
21 tailoring salt application strategies to
22 the weather and the product being used.
23 For example, certain road salts such as
24 sodium chloride are only effective at
25 ambient temperatures over 20 degrees. At

1 3/10/22 - STREETS - RES. 220132

2 lower temperatures, this product does not
3 protect drivers and only exacerbates
4 water pollution when the weather gets
5 warmer.

6 Number two, calibrating salt
7 spreaders on salt trucks and using road
8 temperature sensors. Calibrated salt
9 spreaders and brining allow for a better
10 understanding of how salt is being
11 applied. Greater use of temperature
12 sensors can dramatically reduce excess
13 applications before predicted storms. If
14 road temperatures are above freezing,
15 pre-treatment might not be needed, or the
16 amount of salt applied could be
17 dramatically reduced.

18 Number three, training and
19 certification for snowplow drivers and
20 contractors who maintain walkways,
21 parking lots, and service roads on
22 private property. Testing by Salt Watch
23 volunteers and the experience of state
24 and local governments demonstrate that
25 excessive salt application is common

1 3/10/22 - STREETS - RES. 220132

2 among private contractors, but simple
3 training can quickly improve their
4 practices.

5 And, number four, educating the
6 public about how road salt works and what
7 is an appropriate amount to apply on
8 their own property. For example, one
9 12-ounce mug is enough rock salt for a
10 20-foot driveway or 10 sidewalk squares.

11 Threats from road salt do not
12 end in the spring. Warm water coupled
13 with reduced stream flow during the
14 summer months means chloride levels will
15 be even more concentrated, putting stress
16 on wildlife and drinking water treatment
17 plants. It is vital to decrease road
18 salt application in the winter months to
19 conserve resources, protect wildlife, and
20 maintain safe drinking water for
21 generations to come, all while still
22 maintaining public safety.

23 Thank you for your time.

24 COUNCILMAN THOMAS: Thank you
25 for your testimony. We appreciate it.

1 3/10/22 - STREETS - RES. 220132

2 Madam Clerk, would you please
3 call the next witness for this panel.

4 THE CLERK: The last witness
5 for this panel is Denver Preston.

6 COUNCILMAN THOMAS: Please
7 state your name for the record and you
8 may begin with your testimony.

9 (No response.)

10 COUNCILMAN THOMAS:
11 Mr. Preston, we seen you briefly, but if
12 you're talking, you're on mute.

13 MR. PRESTON: How is that?

14 COUNCILMAN THOMAS: Great.
15 Good afternoon. Please state your name
16 for the record and you may begin with
17 your testimony.

18 MR. PRESTON: Okay. My name is
19 Denver Preston. I'm with K-Tech
20 Specialty Coatings in Ashley, Indiana and
21 we're in the deicer business. We
22 manufacture a deicer called Beet Heet. I
23 want to start out by thanking
24 Councilmember Thomas and the other
25 Councilmembers for calling this hearing

1 3/10/22 - STREETS - RES. 220132
2 to consider alternative deicing
3 materials, and I also want to thank you
4 for giving me an opportunity to share my
5 testimony.

6 I've been in this field for
7 12 years. I've seen many agencies
8 achieve amazing reductions in chloride
9 emissions, and for some, the reduction
10 was achieved very, very easily.

11 So I've been told that you have
12 the handout that I provided, Mr. Thomas.

13 COUNCILMAN THOMAS: Yes.

14 MR. PRESTON: So the title here
15 is The Boost and Reduce Method. So I'm
16 going to tell you right here and now the
17 information that I'm going to go over
18 today is super, super easy to understand.
19 Okay? Very, very easy to understand.
20 And it starts out with Page 1, what I
21 call simple logic, and that simple logic
22 is, the better your rock salt or chloride
23 performs, the less of it you need to
24 maintain the same exact level of service.

25 Now, if you will turn with me

3/10/22 - STREETS - RES. 220132

to Page 2, what we have here is, we have ice melt capacity results. We hired an independent laboratory to do these ice melt capacity tests for us as we were developing our product. And so over on the left-hand side here, I want to show you, this is how much ice untreated rock salt melted in a 60-minute time period at 25 degrees Fahrenheit. Okay? So untreated rock salt.

To the right of it, we have brine-treated rock salt. Okay? Now, you can see right there that the additional ice melt capacity was less than one percent more than the untreated rock salt. And the primary reason for this is, brine on rock salt is nothing more than sodium chloride on sodium chloride. Okay? If you take grape juice and you mix it with grape juice, you have grape juice, just a little bit more of it. So by wetting your rock salt with brine, this is the performance benefit that you get out of this.

1 3/10/22 - STREETS - RES. 220132

2 In the middle here, we have
3 32 percent calcium chloride, and you can
4 see that by putting it on your rock salt
5 at seven gallons a ton, the performance
6 of that rock salt goes up almost
7 20 percent.

8 Now, then we have beet juice.
9 This is a product called Geomelt 55, and
10 if you put it on your rock salt at five
11 gallons a ton, look how much better your
12 salt performs, 27.3 percent more ice melt
13 in one hour than brine-treated rock salt,
14 which is what you guys are using right at
15 this moment.

16 And then to the right of the
17 Geomelt 55 is our product. We call this
18 blend Beet Heet Severe, and it's a 50/50
19 blend of our Beet Heet concentrate and
20 your sodium chloride brine. If you mix
21 these two deicers together and apply them
22 to your rock salt at 10 gallons per ton,
23 look at the performance boost here.
24 Okay? Sixty-four percent more ice melted
25 in the 60 minutes than brine-treated rock

1 3/10/22 - STREETS - RES. 220132

2 salt.

3 Now, why do we talk about
4 performance here? It goes back to my
5 original statement, the better your rock
6 salt works, the less of it you need to
7 maintain exactly the same service levels.

8 So if you turn with me to Page
9 3, again talking about this boost and
10 reduce method, here is simple
11 mathematical logic. If salt B melts
12 64 percent more ice than salt A, then
13 salt B can melt the same amount of ice as
14 salt A with 39 percent less rock salt.
15 Or in our discussion today, 39 percent
16 less chloride emissions into your
17 environment. Okay? Are you with me?

18 COUNCILMAN THOMAS: Okay. So
19 we are. I don't know if I'm allowed to
20 say that as the Chair, but we are.

21 MR. PRESTON: All right. So
22 Page 4 here is a visual. So the only
23 thing that I'm trying to show --

24 COUNCILMAN THOMAS: Let me do
25 this too, since I already interrupted you

1 3/10/22 - STREETS - RES. 220132

2 once, for those who are listening to the
3 hearing, Mr. Preston submitted documented
4 testimony, and so as he's going through
5 the pages, he's going through a document
6 that he's already submitted to members of
7 the Streets Committee that basically
8 outlines his testimony.

9 So I just wanted to put that
10 out there for those in the listening
11 audience that may be listening.

12 Go ahead, Mr. Preston. I'm
13 sorry.

14 MR. PRESTON: Thank you. Thank
15 you.

16 So on Page 4 here, we just have
17 a visual, and the little pile of salt
18 there that's colored, that would
19 represent the organic-treated rock salt,
20 and that pile is 39 percent less than the
21 brine-treated rock salt that is right
22 there. So 39 percent less chloride by
23 simply adding a liquid deicer to your
24 rock salt. Okay?

25 Now, you might also see right

1 3/10/22 - STREETS - RES. 220132
2 below where it says 39 percent less
3 chloride, it also says return on
4 investment, over 267 percent. Okay?

5 Now, let's talk about the cost
6 to use these products. Earlier
7 testimony -- and I have a quote in here
8 we'll touch on in just a little bit, but
9 earlier testimony mentioned that these
10 organic deicers or manufactured deicers
11 are significantly more costly. This is
12 something that it's hard to understand
13 why people can't grasp this simple
14 mathematical logic on this. Yes, the
15 organic deicer is more money than the
16 brine, but when you look at the cost
17 savings of reducing your salt application
18 rate by 39 percent, that argument of
19 being significantly more costly is
20 nonsense, pure nonsense.

21 So on Page 5, I inquired as to
22 how much rock salt the City of
23 Philadelphia uses, and the ten-year
24 average is 34,700 tons or 34,700 tons of
25 chloride. Now, if you reduced your

1 3/10/22 - STREETS - RES. 220132
2 chloride application rate by 39 percent,
3 that means the City would reduce its salt
4 consumption by 13,561 tons or, another
5 sort of visual here, 542 semi loads of
6 rock salt.

7 Now, if you put those semis
8 nose to tail, I did the calculation the
9 other day, and that line of semis hauling
10 rock salt would be about 24 miles long if
11 you put them from nose to tail. So what
12 we're talking about here is reducing your
13 chloride emissions by 13,500 tons and 542
14 semi loads of chloride. All right?

15 Now, Page 6 gets a little bit
16 more into the numbers, and if you just
17 look there in the top blue line that says
18 enter data here, this is what we call a
19 salt savings calculator. You might as
20 well call it a chloride savings
21 calculator. And I've got the 34,700 in
22 there tons that you use on average. I
23 have \$64 a ton. I'm assuming that your
24 brine that you're making inhouse is
25 costing about \$0.20 per gallon. That's

1 3/10/22 - STREETS - RES. 220132

2 most DOTs across the United States pick
3 that cost at about \$0.20 a gallon. I
4 have it calculated that you're putting it
5 on at seven gallons a ton.

6 Now, the next blue line there,
7 Line No. 5, has \$1.18 in it, and that
8 would be the cost of our product once you
9 purchase our product and mix it 50/50
10 with your brine. So \$1.18 a gallon.
11 Yeah, that is significantly more money
12 than your \$0.20 a gallon for your brine,
13 but when you add performance into the
14 equation, we go down to the yellow
15 section down here. We see 64 percent
16 better performance means you can back
17 your application rate down 39 percent.
18 That would equate to the 542 semi loads
19 of rock salt. And your net savings would
20 be somewhere in the ballpark of \$667,000
21 or a return on investment of 267 percent.

22 The next line below that, let's
23 go to the red boxes, if you want to take
24 a look at that. The last box says
25 41.63 percent. What that line represents

1 3/10/22 - STREETS - RES. 220132

2 is the amount of money that you are
3 actually spending more than what you need
4 to spend. If you continue on with your
5 brine on rock salt maintenance methods,
6 you're going to be spending about
7 41 percent more money than necessary.
8 And all you've got to do is make the
9 transition to the much better-performing
10 product that you're putting on that rock
11 salt, which would be very easy for you
12 guys to do.

13 So then Page No. 7 here, what
14 does this 267 percent return on
15 investment really look like in layman's
16 terms? That means for every \$1 that you
17 spend on this better-performing liquid
18 deicer, you're going to save \$2.67. So
19 invest \$1, save \$2.67. Okay?

20 Page 8, Beet Heet and the
21 environment, and let me just say that
22 I've listened to all of the testimonies
23 today and I'm 100 percent on board with
24 your environmental experts. Yes,
25 chloride is a huge problem. I deal with

1 3/10/22 - STREETS - RES. 220132

2 an organization in Chicago called The
3 Conservation Foundation. I sponsor
4 workshops that they put on to lower
5 chloride emissions. I think their work
6 is amazing. And lo and behold, we have
7 about 40 agencies in the Chicago land
8 area that are using our product to lower
9 their chloride emissions, but let me
10 touch on -- I have four things here.

11 Number one, our product, as
12 I've already pointed out, can give you
13 the ability to reduce your chloride
14 emissions up to 39 percent. Our product
15 is ready biodegradable in nine days. It
16 is 99 percent biodegradable in 28 days,
17 and the biological oxygen demand, or BOD,
18 is zero at 39 degrees Fahrenheit. Zero.
19 All right? And I'm going to add a fifth
20 one that I did not put in the
21 presentation, because I heard in some of
22 the other testimonials talking about
23 corrosion. Our product, our Beet Heet
24 concentrate that you would be mixing with
25 your brine, is 86 percent less corrosive

1 3/10/22 - STREETS - RES. 220132
2 than salt, 86 percent less corrosive.
3 And when you mix our product with your
4 brine, it's then 75 percent less
5 corrosive than rock salt or brine. Okay?

6 So five things there from an
7 environmental standpoint that you really,
8 really need to consider. It's -- like I
9 said earlier, this is very, very easy to
10 understand.

11 Now, on Page 9, this is the
12 quote that I talked about a little bit
13 earlier, and I took the time to read some
14 newspaper articles in the Philadelphia
15 region before preparing for my testimony
16 today, and one quote I have here is from
17 the Pennsylvania DOT. It was in the
18 Philadelphia Inquirer on January 11th of
19 2022, and it says, and I quote,
20 "Materials such as manufacturing and
21 agricultural by-products, manufactured
22 deicing composites, and treated salt have
23 proven effective at low temperatures, but
24 cost significantly more than rock salt."

25 Okay? I've already touched on

1 3/10/22 - STREETS - RES. 220132
2 this. This is an argument that cannot
3 stand on its own. Yes, it's expensive in
4 comparison with brine, but when you
5 consider the performance benefits, brine
6 is one of the least cost-effective
7 deicers anyone could ever use, the least
8 cost effective.

9 I don't have that argument in
10 my presentation today, but I'd surely
11 like to meet you some day or have another
12 meeting where we could go over some of
13 these other things that I don't have time
14 today.

15 Now, on this last page, this is
16 a map, and this map right here, just so
17 everybody can see it, all right, this map
18 is -- all of these little push pins are
19 where our customers are at. And so here
20 is Pennsylvania, right there, and here's
21 the rest of the world. The rest of the
22 world is right here. Okay?

23 My advice to you from this
24 point forward is, you need to talk to
25 people, agencies, cities, DOTs that are

1 3/10/22 - STREETS - RES. 220132
2 using these products. They can very
3 easily convince you that -- they're going
4 to tell you you must use these products.
5 It's a no-brainer. And you should guard
6 yourself against listening to people that
7 are ten years behind the technology.

8 So with that, I'll end my
9 presentation, but I'd love to take some
10 questions from you and some of your other
11 Councilmembers.

12 COUNCILMAN THOMAS: Thank you.
13 Thank you for your presentation.

14 I am going to open it up to my
15 colleagues if there are any members of
16 this Committee who has any questions for
17 this particular panel or this particular
18 set of witnesses.

19 (No response.)

20 COUNCILMAN THOMAS: We had
21 about five different people on this
22 particular panel talking about a number
23 of issues and discussing options for the
24 City of Philadelphia.

25 What I will say to everyone on

1 3/10/22 - STREETS - RES. 220132
2 the panel and to everyone that's a part
3 of the conversation, this is just the
4 step for us in the City of Philadelphia.
5 This is the first time that we've had a
6 conversation like this in recent history,
7 especially post-pandemic. We need to be
8 as efficient and as effective as a city,
9 thinking about how we can best serve the
10 citizens of Philadelphia and making sure
11 that we are being as environmentally
12 friendly as possible.

13 And so I think that we've
14 gotten a lot of recommendations here
15 today. Before we move on, I just want to
16 see if there is anybody who would like --
17 anybody who is present, whether it's
18 members of the Committee or witnesses
19 that's here today, that would like to add
20 anything to the conversation that has not
21 yet been added.

22 (No response.)

23 COUNCILMAN THOMAS: Are there
24 any questions, comments from members of
25 the Committee as well as any of our

1 3/10/22 - STREETS - RES. 220132
2 members of this panel, anybody would like
3 to add anything to the conversation
4 today?

5 (No response.)

6 COUNCILMAN THOMAS: There being
7 none, I want to thank everybody on this
8 panel for your testimony today. It's
9 greatly appreciated. Thank you for your
10 insight, for your information, your
11 expertise, your willingness to partner
12 with the City of Philadelphia, and your
13 availability to continue to be a resource
14 to us as we move into budget season and
15 determine how much money we're going to
16 spend on these different areas and how
17 those dollars will be allocated.

18 So please make sure that you
19 continue to work with us and put us in a
20 position to make sure that we're making
21 the decisions that are in the best
22 interest of the City of Philadelphia.

23 So there being no further
24 questions from members of the Committee
25 and no other witnesses to testify here

1 3/10/22 - STREETS - RES. 220132

2 today, I will ask, as I did multiple
3 times, if there's anyone else present in
4 this hearing whose name we have failed to
5 call that wishes to offer testimony on
6 any of the bills being considered today?

7 (No response.)

8 COUNCILMAN THOMAS: There being
9 none, I want to thank everybody on the
10 panel and all the witnesses for their
11 participation today. We appreciate your
12 presence, and this concludes our hearing
13 on the Streets and Services Committee.

14 Thank you, Madam Clerk, and
15 your entire team. Your work is greatly
16 appreciated, and thank you for everybody,
17 the members of the Committee and the
18 expert witnesses who were involved in
19 this conversation, as well as the folks
20 behind the scenes who made this happen.
21 This was a great dialogue. It was a lot
22 of information, and we have work to do.

23 Thank you, everybody. Have a
24 good day.

25 - - -

1 3/10/22 - STREETS - RES. 220132
2 (Committee on Streets and
3 Services concluded at 2:58 p.m.)

4 - - -

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25

CERTIFICATE

I HEREBY CERTIFY that the
proceedings, evidence and objections are
contained fully and accurately in the
stenographic notes taken by me upon the
foregoing matter, and that this is a true and
correct transcript of same.

MICHELE L. MURPHY
RPR-Notary Public

(The foregoing certification of this
transcript does not apply to any reproduction
of the same by any means, unless under the
direct control and/or supervision of the
certifying reporter.)

<u>WORD</u> <u>INDEX</u>					
< \$ >	2 101:2	62:1 63:1	26:1 27:1	39 103:14, 15	8.3 22:2
\$0.20 106:25	2,200 37:16	64:1 65:1	28:1 29:1	104:20, 22	80s 56:24
107:3, 12	2:58 116:3	66:1 67:1	30:1 31:1	105:2, 18	840 62:8
\$1 108:16, 19	20 12:18 19:5	68:1 69:1	32:1 33:1	106:2 107:17	86 109:25
\$1.18 107:7, 10	20:10 21:22	70:1 71:1	34:1 35:1	109:14, 18	110:2
\$15.4 28:15	22:6 42:15	72:1 73:1	36:1 37:1	< 4 >	< 9 >
\$2.67 108:18, 19	51:24 53:3	74:1 75:1	38:1 39:1	4 103:22	9 110:11
\$3 28:18	55:2 60:15, 25	76:1 77:1	40:1 41:1	104:16	90s 56:24
\$64 106:23	96:25 102:7	78:1 79:1	42:1 43:1	40 55:2 109:7	99 109:16
\$667,000	200 60:4, 6	80:1 81:1	44:1 45:1	400 52:2	< A >
107:20	2005 53:5	82:1 83:1	46:1 47:1	41 108:7	AAA 26:7, 8
< 1 >	2012 27:21	84:1 85:1	48:1 49:1	41.63 107:25	27:19 28:21, 23
1 100:20	2016 27:20, 21	86:1 87:1	50:1 51:1	45 16:14	ability 20:24
1,000 53:11	2017 8:8	88:1 89:1	52:1 53:1	47:14, 24	109:13
60:11	2018 93:18	90:1 91:1	54:1 55:1	48 11:15	able 23:24
1:09 1:7	2020 94:24	92:1 93:1	56:1 57:1	< 5 >	32:18 38:22
10 1:7 2:4	2021 61:18	94:1 95:1	58:1 59:1	5 60:24	47:24 49:7
53:7 60:15, 24, 25 71:15	94:24	96:1 97:1	60:1 61:1	105:21 107:7	85:7
98:10 102:22	2022 1:7 2:4	98:1 99:1	62:1 63:1	50 53:22	absent 75:7
10,000 53:11	110:19	100:1 101:1	64:1 65:1	55:24 60:2	Absolutely
100 21:17	2023 32:12	102:1 103:1	66:1 67:1	67:3 71:13	92:17
40:5 46:13	37:23	104:1 105:1	68:1 69:1	93:14	accelerate
47:25 53:7	2024 37:24	106:1 107:1	70:1 71:1	50,000 9:21	27:12
60:3 71:13	20-foot 98:10	108:1 109:1	72:1 73:1	50/50 102:18	access 41:2
94:20 95:10	20's 12:25	110:1 111:1	74:1 75:1	107:9	81:25
96:10 108:23	31:9	112:1 113:1	76:1 77:1	500-foot 8:17	accurately
11,000 78:9	210 20:23	114:1 115:1	78:1 79:1	51 27:25	117:5
11th 110:18	22 43:16	116:1	80:1 81:1	542 106:5, 13	acetate 23:7, 8
12 21:25	220,000 71:20	22-inch 8:8	82:1 83:1	107:18	achieve 19:3
42:12 100:7	220132 1:12	23 16:9 43:18	84:1 85:1	55 47:25	100:8
120 20:18	2:1 3:1 4:1,	67:9	86:1 87:1	102:9, 17	achieved
12-ounce 98:9	23 5:1, 2 6:1,	230 94:22	88:1 89:1	< 6 >	16:25 100:10
13,500 106:13	14 7:1, 6 8:1	95:13	90:1 91:1	6 21:24	Act 6:6 10:13
13,561 106:4	9:1 10:1 11:1	24 16:16	92:1 93:1	106:15	53:17, 23
131 39:22	12:1 13:1	43:16 106:10	94:1 95:1	60 16:16	action 18:23
40:3 42:2	14:1 15:1	25 16:13 19:9	96:1 97:1	102:25	activate 12:25
135 40:23	16:1 17:1	20:18, 22	98:1 99:1	6-0 15:22	active 35:16
41:10	18:1 19:1	21:16, 18	100:1 101:1	60-minute	acts 11:23
15 16:15 28:7	20:1 21:1	101:10	102:1 103:1	101:9	21:11
58:21	22:1 23:1	250 62:7	104:1 105:1	64 103:12	actual 22:22
150 60:4	24:1 25:1	267 105:4	106:1 107:1	107:15	74:9
16 20:4 24:7	26:1 27:1	107:21 108:14	108:1 109:1	< 7 >	ADA 38:4
17 20:5	28:1 29:1	27.3 102:12	110:1 111:1	7 42:12	adapted 83:3
170 21:19	30:1 31:1	275 94:17	112:1 113:1	108:13	add 13:9 20:6
18 12:18	32:1 33:1	28 109:16	114:1 115:1	70 31:8 32:10,	23:9 24:9
37:13 49:4	34:1 35:1	< 3 >	116:1	12 37:19	31:23 32:4
19 61:17	36:1 37:1	3 103:9	30 19:11	38:10 41:7	39:13 48:13
1940 53:9, 12	38:1 39:1	3/10/22 2:1	21:22 22:6	55:24	59:2 66:4
1940's 58:23	40:1 41:1	3:1 4:1 5:1	37:25 38:11	70s 60:3	70:23 73:18
1970's 60:23	42:1 43:1	6:1 7:1 8:1	53:3 71:15	72 11:16	107:13 109:19
< 2 >	44:1 45:1	9:1 10:1 11:1	30-year 42:15	75 110:4	113:19 114:3
	46:1 47:1	12:1 13:1	32 102:3	< 8 >	added 13:12
	48:1 49:1	14:1 15:1	34,700 105:24	8 108:20	23:2, 5 113:21
	50:1 51:1	16:1 17:1	106:21		adding 19:22
	52:1 53:1	18:1 19:1	35 19:13		20:8 22:3
	54:1 55:1	20:1 21:1	37:12, 22, 25		104:23
	56:1 57:1	22:1 23:1	49:4 78:3, 5		
	58:1 59:1	24:1 25:1	80:15		
	60:1 61:1				

addition 7:19 62:13	ago 13:3 22:12 41:24	animals 82:24 84:5 85:11	81:15 92:16 114:9 115:16	76:4 105:24 106:22	beloved 72:14 87:3
additional 13:13 47:25 88:11 101:14	60:3 93:14	90:13, 19	approach 87:7	aware 5:15 46:22 53:19	Belt 23:12 34:12
Additionally 5:22 73:4	agree 50:2	announcement 2:9	appropriate 10:9 98:7	< B >	Ben 74:6
additives 22:8 88:5, 11	agricultural 12:15 22:20 110:21	annual 28:16 39:22 42:2 60:8	appropriately 12:3	back 10:6 18:13 19:12 25:16 37:22 44:8, 19, 22 48:3 53:8 57:22 60:2 103:4 107:16	benefit 19:18 101:24
address 30:15 35:12 46:18 89:14 94:13	ahead 17:11, 25 33:17, 19 41:16 67:19 92:14 104:12	answer 15:2 36:17	approximately 37:16	bad 46:20 91:14	benefits 13:4 16:23 111:5
addressed 35:23 66:11	aid 47:8	anti-bonding 11:24	aquatic 51:18 62:5, 13 72:7 83:5, 10 84:14 95:6, 14 96:8	bag 80:13	best 9:17 32:5 34:23 35:10 38:17 64:7, 11, 16 66:17, 19, 21, 22 87:14 96:19 113:9 114:21
addresses 49:10	air 93:9	anti-icing 16:6	Arboretum 69:22	bagged 24:10	better 9:20 16:24 20:2 21:11 36:13 43:14 44:5 47:22 62:16 63:7 66:2 81:10 87:22 94:14 97:9 100:22 102:11 103:5 107:16
addressing 86:23	Airport 8:19	anti-skid 10:13	area 10:25 52:12, 24 60:13 62:21 71:5 72:13 73:13 91:2 109:8	bags 24:10, 15	better- performing 108:9, 17
adjust 42:25	Airy 69:13 74:7	anybody 113:16, 17 114:2	areas 58:17 67:6 114:16	balance 7:11 9:14 64:5	Beyond 27:13 84:18 86:13 89:9
adjustment 43:2	alarming 90:21 95:22	apologies 46:9	argument 105:18 111:2, 9	balanced 57:2	big 35:16 54:21 75:4
adjusts 67:12	algal 88:21	apologize 41:17	arterials 42:11	ball 65:22	biggest 43:10
administration 10:24 11:6 32:9	alleys 79:5	apparent 53:18	articles 110:14	ballpark 107:20	Bill 4:22 6:9, 11 51:8 68:21
adopt 94:14	allocated 114:17	appliances 73:6	Ashley 99:20	barrier 65:16	billion 28:15, 18
ADT 42:6	allow 6:3 12:19 15:7 82:11 97:9	application 16:11 20:17, 21 21:3, 14, 17, 18 24:13 58:13 74:2, 15 75:21 87:25 88:4 96:21 97:25 98:18 105:17 106:2 107:17	asked 15:23 56:25	bars 16:21	bills 4:25 115:6
adults 72:12	allowed 103:19	21 21:3, 14, 17, 18 24:13 58:13 74:2, 15 75:21 87:25 88:4 96:21 97:25 98:18 105:17 106:2 107:17	asking 40:20	base 60:20, 22 84:3	bioassays 52:4
advance 1:17 5:7	allows 21:12	18 24:13 58:13 74:2, 15 75:21 87:25 88:4 96:21 97:25 98:18 105:17 106:2 107:17	asphalt 31:12, 16 42:4	based 20:20 63:22 70:3	biodegradable 109:15, 16
advantage 23:15	alongside 85:6	58:13 74:2, 15 75:21 87:25 88:4 96:21 97:25 98:18 105:17 106:2 107:17	assistance 14:17	baseline 94:11	biological 13:13 109:17
advice 111:23	alternative 22:14 100:2	75:21 87:25 88:4 96:21 97:25 98:18 105:17 106:2 107:17	Assistant 15:20	basically 16:8 104:7	bird 72:13
Advocate 81:22	alternatives 26:25	105:17 106:2 107:17	assuming 106:23	Basin 52:3 61:20	bit 23:18 36:19 44:22 45:7 101:22 105:8 106:15 110:12
advocating 48:21 93:12	amazing 100:8 109:6	applications 56:16 97:13	assumption 74:13	basins 61:13, 16 62:16, 19	blade 67:12 87:14
Affairs 26:7	ambient 96:25	applicators 54:21 66:7 74:20 75:8, 13	attendance 3:2, 3	basis 28:16	blades 67:12
affect 72:5 73:2	America 93:4	74:20 75:8, 13	audience 40:21 104:11	BASS 1:10 3:16, 17 46:4, 7, 8 47:20 48:10	blend 102:18, 19
aforementioned 89:6	American 77:25 86:4	applied 11:15 21:8 27:3 89:12 97:11, 16	augers 10:5	beet 12:11, 12, 14, 19, 22 13:2, 6, 10, 14 22:9, 10, 22 23:3 56:9 88:6, 18, 20 99:22 102:8, 18, 19 108:20 109:23	
afternoon 2:3 3:15, 18, 21, 23 4:2, 6, 8 6:12, 18, 22 15:15, 18 25:24 26:3 29:14 51:16 69:9 99:15	Americans 96:10	21:8 27:3 89:12 97:11, 16	authorities 94:13	Beets 1:16 5:5 7:7 12:13	
agencies 100:7 109:7 111:25	amount 25:2 31:18 43:19 49:3 75:15 80:3, 5 81:7 88:7 97:16 98:7 103:13 108:2	apply 16:18 17:24 18:4 34:6 76:2 82:14 98:7 102:21 117:22	Authority 14:21, 23	beginning 2:9	
agent 11:24	amounts 59:9 74:18 78:25	16:14 17:11 18:22 61:3 65:6	authorizing 1:12 5:3	begins 10:3	
aggregates 10:12	amphibian 83:17	appreciate 42:17 57:9 63:17 77:14 98:25 115:11	availability 114:13	behalf 26:8	
aggressive 67:6	amphibians 72:6 83:11	appreciated 68:18 77:13	available 6:3 88:22 94:6	behold 109:6	
agitation 25:9	analysis 22:25		average 22:3 42:6 60:7, 8	belief 19:25	
	analyzing 53:20			believe 23:2, 4	
	and/or 117:24				

blessed 86:25	brined 17:7	51:7 57:11, 25	challenge 38:2	15, 20 63:4	77:16, 19
blizzard 8:8	73:20	68:20 77:17	43:10 54:23	85:4 86:25	81:16, 18 92:8,
block 91:12	brine-making	81:17 99:3	89:13	87:23 90:14	10, 17 99:2, 4
blood 72:24	11:21	100:21 102:17	challenges	111:25	115:14
86:11 95:18	brines 17:25	106:18, 20	8:10 56:3	citizens 72:22	climate 27:24
blooms 88:21	brine-treated	115:5	93:16	76:19, 23	28:8 35:7
blown 17:15,	101:13 102:13,	called 3:5	challenging	113:10	36:6
18	25 104:21	4:20 6:9	56:17	CITY 1:2	climates 28:2
blue 106:17	bring 8:6	99:22 102:9	change 36:7	2:12, 18 3:19	CLIP 14:20
107:6	brining 11:7	109:2	channels 45:12	7:18 9:2, 5, 12,	close 49:19
board 108:23	12:12 43:20	calling 99:25	characteristics	20 10:8, 19	closer 49:9
BOD 109:17	67:7 97:9	capable 91:8	27:8	12:11, 21 16:3	Club 77:25
bodies 30:3	BROOKS	capacity 9:20	charge 64:13	30:14 31:10	coastal 67:5
body 81:8	1:11 4:4, 5	50:14 81:23	charts 70:19	32:11, 15	coat 27:11
bond 17:3	bucket 24:10	101:3, 5, 15	Chat 6:2, 6	35:16, 17	Coatings 99:20
bonded 17:10	budget 38:8,	carbonate	29:22 45:19	37:14 38:4, 23	Cobb 58:19
bonds 11:25	10 48:22	78:22	63:19	39:4, 5 42:10,	60:5
Boost 100:15	49:22 54:25	care 78:13	check 77:15	22 44:13 45:2,	coffee 76:6
102:23 103:9	114:14	87:10	chemical 17:6	4, 15, 24 47:9,	cold 33:5
booties 79:17	budgets 54:18	carry 42:7	22:25 43:12	15 49:12	colder 79:20
bottom 45:13	building 40:25	cars 34:4	64:5	55:16 58:13	collaboratively
bottoms 72:9	buildings	73:9 75:20	chemicals	64:2, 14 72:17	89:15
box 75:4	24:16	cause 27:14	26:19 27:9	73:22 76:25	collar 89:16
107:24	burgeoning	28:5 32:21	28:4, 11 29:5	78:11 79:19	colleagues
boxes 107:23	76:13	33:2 34:15	Chestnut 8:20	80:20 82:5, 7,	3:12, 18 29:17
BPN-2 19:6	business 19:10	35:4 78:17	Chicago 77:22	25 85:21	44:14 45:19
brainstorm	99:21	80:13 85:10	78:5, 6, 11	86:16 89:13	112:15
50:24	businesses	88:21	81:11 109:2, 7	90:13, 16, 19,	collection 94:5,
brakes 27:15	63:6 65:2, 25	caused 28:10	Chief 7:3	23 91:8, 9, 21	9
Branch 93:21	66:2 73:7	causing 73:7	31:2 32:2	105:22 106:3	color 91:11
break 84:15	90:24 91:23	cave-ins 39:7	43:8 77:24	112:24 113:4,	colored 104:18
breaks 7:24	butterfly 85:14	Center 51:20	Chihuahua	8 114:12, 22	combat 26:18,
bridges 73:9	by-product	centers 75:5	80:2, 5	City's 11:8	24
brief 3:6	12:13	78:8	chime 42:8	13:20, 22	come 2:24
83:19	by-products	Central 60:19	chloride 22:4	14:15 82:17	24:8 41:22
briefly 99:11	110:21	century 93:15	23:4, 7 24:4,	83:5	44:19 55:15
Briggs 92:19,	< C >	certain 9:11	23 69:23	citywide 76:22	57:22 98:21
23, 25	calcium 23:4	35:17 42:6	70:14 71:9	Clean 14:4	comes 12:10
Brine 1:16	24:4, 10 25:11	80:5, 21 96:23	72:5, 25 78:19,	53:17, 23 76:9	45:14 54:12
5:5 7:7 11:5,	78:21 88:11,	certainly 18:5	20, 21 86:14	81:21 82:2	88:20
11, 12, 14, 18,	25 102:3	64:19	88:12 94:2, 20	85:4 92:25	coming 35:23
20, 23 12:5, 8,	calculated	CERTIFICAT	96:24 98:14	93:12 96:19	45:3, 5 48:15
16, 19 13:8	107:4	E 117:2	100:8, 22	Cleanup 17:8	65:23 73:16
16:7, 11 17:11,	calculation	certification	101:19 102:3,	clear 7:14	comments
14 18:4 21:6,	106:8	66:13 97:19	20 103:16	14:17 22:18	5:24 113:24
24 22:8 23:15	calculator	117:21	104:22 105:3,	33:23 34:5	commercial
24:2 25:8	106:19, 21	CERTIFY	25 106:2, 13,	79:16	7:17
26:11 31:15	Calendar	117:3	14, 20 108:25	clearing 7:11	Commissioner
34:2, 5, 6	32:11 37:23	certifying	109:5, 9, 13	61:11	6:16, 21, 25
43:15 56:8	calibrate 20:25	117:25	chloride-laced	clearly 30:5	30:18, 23, 25
65:12 70:23	Calibrated	CHAIR 1:10	72:4	63:25 64:4	32:5, 19 36:16
71:22 88:4, 14	97:8	3:10, 12 30:5	chlorides 23:2,	Clerk 3:9, 10,	39:14, 17, 20
101:18, 23	Calibrating	46:7 103:20	8 72:23 88:25	16, 22 4:3, 9,	40:2, 7, 12, 19,
102:20 105:16	10:5 97:6	Chairman	89:4	11, 14 5:2	23 41:4, 14, 17,
106:24 107:10,	call 2:25 6:9,	3:18 4:14	Chris 70:6	6:13 15:10, 12	19, 24 43:6
12 108:5	10 15:11	6:22 46:5, 19	CINDY 1:10	25:19, 21 51:7,	46:23, 25 48:6
109:25 110:4,	25:20 36:6	47:21 48:4	circle 25:16	9 57:10, 12, 20,	51:4
5 111:4, 5	42:13 47:7		cities 35:8, 10	21 58:2, 7	commit 40:24
			36:9, 11 38:14,	68:19, 22	

COMMITTEE 1:3, 16 2:4 4:19, 21 5:3 6:24 26:5 29:11, 18 40:22 45:22 48:5 49:16 63:19 68:11 69:11 104:7 112:16 113:18, 25 114:24 115:13, 17 116:2 committees 2:12, 18 common 18:18 79:8 97:25 commonly 53:7 54:16 communicated 49:23 50:5 communication 64:23 65:7, 8 communities 65:24 85:5 91:10 community 89:20 94:2 compare 59:6 60:23 comparing 38:13 comparison 111:4 compelling 77:8 complaints 35:25 completely 35:2 50:4 64:12 completes 18:13 complex 46:3 68:5 complexes 75:5 comply 6:5 components 26:20 27:11 composites 110:22 comprised 78:19 compromises 84:3 computers 65:11	concentrate 85:8 102:19 109:24 concentrated 98:15 concentrations 53:6, 11, 24 54:4, 5 58:22 59:25 60:10, 13 62:8 83:8 86:8 95:12, 13 concern 30:15 concerned 28:2, 23 29:4 50:11 concerns 26:10 49:23 73:3 conclude 25:12 concluded 116:3 concludes 14:25 25:18 29:7 57:6 81:12 115:12 condition 8:15 84:13 conditions 8:3 16:24 17:13 86:11 95:19 96:5 conduct 22:13 conductivity 59:20, 21 confirm 95:4 conflicting 63:25 conjunction 22:17 connected 57:21 58:4 68:24 connection 87:24 consenting 5:21 Conservation 81:22 93:5 109:3 conserve 93:6 98:19 consider 100:2 110:8 111:5 considered 115:6 considering 90:22 constant 25:9	constituents 30:16 constructed 8:14 consume 85:19 consumption 106:4 contact 79:11 contain 89:3 contained 117:5 contaminate 54:7 contaminated 54:10 contemplate 91:20 content 95:10 continue 20:5 36:16 49:21 50:6, 17, 23 55:23 68:2 108:4 114:13, 19 continued 53:22 70:12 continues 90:18 continuing 5:20 54:7 58:25 continuously 59:20 contractors 97:20 98:2 Contrary 19:25 64:9 contribute 31:17 control 65:11 86:12 117:24 controlled 66:9 conversation 14:5 48:24 49:22 52:15 54:22 55:18 57:5 113:3, 6, 20 114:3 115:19 convince 112:3 Correct 40:8 41:15 43:25 74:18 117:8 correctly 41:13 corridor 8:13 corrode 26:20 corrosion 27:12 86:15 109:23	corrosive 73:5 95:23 109:25 110:2, 5 corrosivity 89:6 cosmetic 27:13 cost 17:22 23:24 24:25 28:13, 17 105:5, 16 107:3, 8 110:24 111:8 cost-effective 111:6 costing 106:25 costly 105:11, 19 costs 55:25 56:2 57:3 COUNCIL 1:2 2:12, 18 90:3 92:4 COUNCILMA N 1:10, 12 2:2 3:11, 14, 20, 22, 23, 25 4:7, 9, 16 5:11 6:17 15:4, 14 25:15, 23 26:4 29:8 32:24 33:15, 17, 18 35:6 39:24 40:4, 9, 18 41:6, 16 42:16 43:21 45:16 46:6 48:12 49:19 51:6, 11 57:8, 14, 19, 24 63:16 67:24 68:14 69:3, 9 77:10 81:13 90:6 92:7, 12, 20 98:24 99:6, 10, 14 100:13 103:18, 24 112:12, 20 113:23 114:6 115:8 Councilmember 4:11 29:13 30:24 31:25 33:4 36:15 39:16 43:7 46:7, 24 92:24 99:24 Councilmember s 99:25 112:11	Councilpeople 15:19 Councilperson 58:11 COUNCILWO MAN 1:10, 11 3:16, 17 4:3, 5 46:4, 8 47:20 48:10 counties 45:6 73:25 89:17 country 9:6 33:10, 11 County 55:16 couple 31:8 36:18 37:7, 12 39:15 41:24 59:12 90:8 coupled 98:12 course 56:17 79:5 86:9 88:3 cover 47:7 covered 14:7 73:22 cracks 27:11 31:12 33:6 34:21, 22 35:2 crack-sealing 34:25 crashes 17:2 create 48:19 87:17 created 14:4 93:14 96:14 creating 31:12 36:5 Creek 69:21 70:8, 14 71:19 creeks 71:2, 4, 10, 13, 23 72:7, 9, 18 73:12 82:17 creep 58:24 59:5 creeping 59:25 60:4 62:24 crevices 27:12 crew 38:25 crisis 49:11 96:2, 3 critiques 42:21 cross 79:6 crowdsourced 93:23 crunchy 74:14 75:10, 16	culminating 78:3 culprit 60:16 curbsides 84:25 current 2:11 32:9 38:4 currently 2:8, 13 15:20 27:23 30:12 Curtis 69:21 customers 111:19 cut 44:22 64:19 cycle 18:9, 10, 11 19:4, 15 31:10, 20 40:15, 17 42:10 cycles 31:6 34:11, 14 42:4 Cycling 19:19 < D > Daily 2:20 42:6 Dakota 52:21 damage 27:14, 15 28:3, 10, 14, 17, 21 29:4 56:3 63:14 73:8 90:18 damages 96:7 damaging 26:10 27:8 Dane 80:2 dangerous 27:14 61:2 78:22 data 53:4, 18 59:12, 17, 24 94:4, 9 95:4 106:18 database 94:6 datasets 59:23 DAVID 1:12 day 106:9 111:11 115:24 days 31:9 91:13 109:15, 16 daytime 12:24 deal 64:16 108:25 dealing 24:5 25:3 29:25 35:7, 9 91:13
---	---	--	--	---	--

debris 76:9	depend 16:12	direct 117:24	downside	educating	96:18
decade 60:3	96:10	direction 91:21	10:18	20:12 43:13	enter 106:18
decades 86:4	dependent	directly 59:21	downstream	65:2 98:5	entire 15:7, 8
decide 88:13	80:3, 21	Director 93:2	89:19	education	115:15
90:25	depending	Director's 14:3	Dr 51:10, 13,	76:11, 22	entomologist
decisions	12:9 24:9	disappointing	16 58:3, 4, 5, 8	effective 9:3	51:19
90:24 114:21	55:4 78:18	46:12	64:18 66:5	11:12 12:17	environment
decrease 56:6	depends 85:14	disastrous 83:6	71:14 75:2	17:16, 17 23:5,	7:13 9:16
87:15 98:17	depresses	discover 70:13	77:20, 21, 22	18 24:12 27:2	44:6 52:8
decreases 84:2	83:13	discuss 39:19	drainage 14:11	96:24 110:23	81:23, 24 82:4
defect 39:5	Deputy 6:15,	discussed	drains 61:22	111:8 113:8	84:16 90:2, 5
definitely	21, 25 30:18,	10:17 13:2	82:16	effects 10:19	103:17 108:21
48:23 50:8	23, 25 32:4, 19	discussing	dramatically	26:10	environmental
77:14 92:15	36:15 39:14,	63:12 112:23	97:12, 17	efficacy 88:5, 8	9:7 13:21
degrees 12:18	17 40:2, 7, 12,	discussion	drinking 44:9	efficiency	43:23 50:13
16:13, 16 20:5,	18 41:4, 14, 17,	41:22 57:2	52:9 56:3	17:20 87:25	52:12 55:25
10, 18, 22	19 43:5 46:23,	103:15	72:17, 20, 22	efficient 113:8	63:13 87:20
21:16 24:7	24 48:6 51:4	disease 72:25	85:24 86:5, 7,	effort 11:2	88:13 108:24
31:8 96:25	destructive	diseases 83:16	18 89:7 95:6,	efforts 9:13,	110:7
101:10 109:18	9:10 34:3	displayed 3:8	16 96:7, 11	23 11:7 14:10	environmentall
deicer 17:21	de-sugared	disrupts 83:11	98:16, 20	32:8	y 50:19 51:2
81:2, 7 99:21,	22:10, 22 23:3	dissipated	drive 60:20	eggs 83:12, 22,	64:8 85:15
22 104:23	detailed 77:12	17:18	drivers 20:12	25	113:11
105:15 108:18	determine	distribution	27:22, 25 28:7,	eight 59:16	EPA 62:6
deicers 26:13,	114:15	55:5	17 97:3, 19	either 27:22	86:8 95:13
17, 24 28:21	determined	District 15:21,	driveway	79:4	equate 75:10
78:17, 18	13:3	22	98:10	elevated 54:6	107:18
102:21 105:10	detrimental	districts 23:11	driving 96:5	72:4, 25 83:20	equation
111:7	62:5	ditches 39:6	dropping	eliminate 9:24	107:14
deicing 53:9	develop 63:2	84:20	37:22	32:6, 18	equipment
87:13 100:2	66:15	diversity 84:24	dry 9:24, 25	emergencies	66:8, 22
110:22	developed	Division 14:19	17:17	78:7, 16 79:10	equipped
Delaware 8:14	10:25 51:24	DNA 90:15	Due 2:11 9:2	emergency	16:20 95:21
45:10 52:2	developing	document	31:4	2:12 10:15	96:12
71:3 72:19	87:24 101:6	104:5	dumped 70:22	78:2, 4, 8, 15	equips 93:24
85:23	development	documented	dumping 30:7	emissions	especially
delivered 14:7	83:12, 22, 24	104:3	< E >	100:9 103:16	19:20 35:20
deliveries 14:8	develops 34:7	dog 78:10	earlier 52:16	106:13 109:5,	52:24 65:25
demand	dialogue	79:24 80:12,	55:11 57:22	9, 14	75:4 113:7
109:17	115:21	25 81:3, 6	87:13 105:6, 9	emphasis 18:8	essentially
demonstrate	diarrhea 80:7	dogs 78:13, 14,	110:9, 13	encourage	30:15
20:14 97:24	diet 95:20	24 79:4, 9, 11,	earth 31:11	54:22, 24	establish 94:10
Denver 99:5,	difference	17, 21 80:16,	easier 17:9	56:13 63:10	established
19	8:18 23:14	18, 19	easily 17:15	encouraging	82:18
Department	34:9	dog's 80:4	66:9 100:10	87:6	establishments
7:2, 4, 23 8:2	differences	doing 35:11	112:3	endangered	75:4, 6
10:15 11:19	65:3	36:9, 11 37:11	easy 55:9, 20	62:15	estimated
13:21, 25	different 8:5	38:16 39:2	62:25 100:18,	ends 71:22	28:14, 17
14:20, 24 32:3	10:10 34:6	44:11 46:2	19 108:11	Engineer 7:4	event 7:10
37:15 39:21	41:11 50:7, 24	59:3 64:7, 10,	110:9	31:3 32:2	10:3 11:13, 16,
43:9 44:7, 15,	59:8, 9, 13	25 67:2, 23	eat 81:7 85:11	43:8	18 12:7 13:15
24 45:4 59:19	65:4 70:20	86:19 90:23	eating 85:19	Engineering	14:12 17:4
73:23 74:17,	80:25 88:17	dollars 46:16	ecologist 51:18	15:22	events 7:8
24 75:13	90:13 112:21	47:5 48:15, 18	Edge 67:11, 17	enjoyment	12:6 15:25
76:20 78:3, 4	114:16	76:21 114:17	edges 65:15	93:8	44:13, 14
82:19	differently	doors 80:23	educate 9:18	enormous	82:15 84:9
departments	39:11 80:24	DOT 110:17	educated 66:19	73:7 75:22	eventually 96:6
26:16, 22	difficult 9:9	DOTs 107:2		ensure 81:25	everybody 2:3,
73:25		111:25			6 4:18 29:16

43:13 50:21 51:3 81:20 111:17 114:7 115:9, 16, 23 evidence 117:4 evolved 93:16 exacerbates 97:3 exact 34:8 100:24 exactly 103:7 example 31:7 38:20 42:8 66:17 85:13 96:23 98:8 examples 56:12 66:24 exceed 82:23 95:11 exceeded 70:18 Excess 95:16, 21, 23 96:13, 16 97:12 excessive 97:25 excited 92:13 excuse 14:8 Executive 15:21 exhaust 27:16 exist 35:18 expands 34:22 expect 47:22 expectation 5:19 expected 16:15 expecting 46:15 expensive 23:20 25:2 111:3 experience 63:23 78:12 81:11 85:18 97:23 expert 63:23 68:17 115:18 expertise 114:11 experts 64:10 84:7 87:8 108:24 explain 20:13 explained 50:8 explore 50:6 68:2 Exploring 10:10 49:25 exposure 95:15	expressways 19:5 extends 52:21 Extension 69:18 extensive 22:17 extent 58:19 extra 70:25 76:9 extreme 24:14 extremely 23:16 eye 65:10, 12, 21 95:3 < F > face 38:3 facing 49:12 68:5 fact 95:22 factor 31:5 72:24 facts 90:10 Fahrenheit 101:10 109:18 failed 115:4 faithfully 85:16 fall 10:4 12:18 falls 12:21 FAMs 47:7 Far 8:22 34:10 35:8 42:20 91:7, 9 fast 12:9 faster 27:5 faucets 73:6 feature 6:2, 6 29:22 45:20 63:20 February 36:25 federal 46:15 47:5, 6, 7, 18, 23 48:7, 14, 18 49:8 66:20 feeding 84:5 feeds 45:13 49:11 feel 64:4 feet 79:12 field 58:17 100:6 fifth 109:19 figure 63:8 91:20 fill 38:22, 24	filter 95:21 96:13 filters 50:14 filtration 95:20 final 25:20 finally 69:23 finches 72:15 find 9:14 48:7 65:23 89:13 finding 71:6 fine 41:20 Fire 8:2 fires 8:4 first 6:14 29:24 30:19, 20, 22 33:23 48:25 51:9 53:4 64:18 66:20 68:22 87:10 113:5 fish 72:6, 11 83:24 88:24 five 27:23 28:6 42:9 102:10 110:6 112:21 five-year 27:21 28:15 flat 67:16 Fleet 14:18 16:22 Flint 96:3 flood 83:4 flow 98:13 flows 71:19 fluctuating 33:9 fluctuation 37:5 flush 61:18, 23 flusher 11:8 focus 12:4 folks 49:4 115:19 following 2:8 13:8 37:21 82:22 follows 2:10 food 72:11, 13 84:4 Force 14:4 forecast 11:17 foregoing 117:7, 21 foremost 48:25 forests 84:4	form 12:16 22:23 27:10 71:21 Fort 60:18 Fortunately 27:16 fortune 51:25 52:6 Forty-four 94:17 forward 37:24 48:24 49:5 50:22 64:4 111:24 found 2:23 61:16 67:20, 22 79:9 86:6 Foundation 59:16 61:15 109:3 four 98:5 109:10 Franklin 74:6 free 93:24 free/thaw 31:6 freeze/thaw 31:10, 20 32:20 33:4 34:11, 14 36:19 37:5 freezes 31:14 freeze-up 34:21 freezing 8:7 17:25 18:20 19:2 20:3, 8 27:4 34:17 36:24 97:14 frequent 87:13 fresh 61:10 83:3 freshwater 95:8 96:9 friendly 50:19 51:2 113:12 Friends 69:15 frogs 83:15 front 84:20 fuel 27:15 full 10:7 76:7 fully 117:5 funded 32:10 59:15 funding 37:11 funds 1:19 5:10 47:4, 6, 19 48:8 further 114:23	< G > gallon 22:2 106:25 107:3, 10, 12 gallons 16:14, 16 21:25 102:5, 11, 22 107:5 Gap 60:19 gardens 84:21 85:17 gastrointestinal 79:22 80:10 gauge 20:19 gauges 59:19 general 56:6 generates 18:24 generations 98:21 Geoffrey 57:13 68:23, 24 69:8, 12 geographical 35:9 geography 8:10 Geological 59:18 Geomelt 102:9, 17 Germantown 69:15 getting 33:5 61:7 71:8 79:20, 22 GILMORE 1:11 4:12 29:13 give 18:16 96:15 109:12 given 19:23 gives 12:2 24:16 giving 100:4 go 20:4, 9, 22 24:19 30:20, 22 33:17, 19 34:12 38:23 41:16 43:24 49:20 53:8 62:23 70:11 75:15 84:18 91:21 92:14 100:17 104:12 107:14, 23 111:12 goal 44:3	goes 24:11 34:13 38:10, 11 41:8 70:25 102:6 103:4 going 13:23 15:6, 7 22:7 35:14, 18 37:19, 24 38:5 39:2 44:8 45:7 47:14 48:23 50:16 51:21 55:2, 10, 17, 22 56:4, 5 62:22, 25 75:20, 21 76:17 78:12 100:16, 17 104:4, 5 108:6, 18 109:19 112:3, 14 114:15 Golden 2:25 4:24 6:8 good 1:18 2:2 3:11, 14, 17, 20, 23, 25 4:5, 7 5:8 6:17, 22 15:14, 18 25:23 26:3 32:7, 15 34:24, 25 38:17 39:23 40:14 44:21 51:16, 25 52:5 56:12 59:23 67:25 69:9 81:5 91:17 99:15 115:24 gotten 113:14 government 10:24 26:7 48:19 governments 97:24 grant 61:15 grape 101:20, 21 grasp 105:13 great 45:25 48:11 79:25 80:2 91:17 99:14 115:21 greater 71:4 97:11 greatly 68:18 92:16 114:9 115:15 Green 62:14
---	--	--	--	--	--

85:3 87:2 ground 84:10 groundwater 54:8, 11 61:8 71:8 group 87:21 grow 84:23 85:7 growth 83:21, 24 grumble 76:19 guard 112:5 guess 36:6 guys 31:22 38:25 67:10 91:17 102:14 108:12 < H > Half 27:25 93:15 94:21 Hampshire 66:12 handful 80:15 handicap 38:7, 9, 10 41:2, 9 handicap- accessible 41:12 handle 23:24 39:9, 10 handling 23:21 handout 100:12 happen 115:20 happens 37:21 happy 15:2 39:18 41:22 90:2 hard 105:12 harm 72:2 95:6 harmful 44:5 harming 77:2 harms 96:8 hatch 72:12 hauling 106:9 hazards 13:23 head 78:4 heading 63:14 headquarters 93:20 health 2:12 73:2 77:3 86:2, 10 95:18 96:2 healthy 1:18 5:8 44:6	71:16 82:7, 8 85:5 87:6 hear 5:12 6:11, 15 58:6 64:19 69:2, 3 heard 27:6 35:12 63:24 109:21 hearing 2:5, 6, 10, 19 4:20, 21 5:16, 17 6:13 33:24 35:24 49:6 58:12 64:9 68:15 77:5 89:10 99:25 104:3 115:4, 12 hearings 1:16 2:15, 17, 22 5:4 heart 72:25 86:10 90:11 heavier 45:7 heavily 76:19 heavy 73:10 76:15 95:25 Heet 22:9 23:3 99:22 102:18, 19 108:20 109:23 Hello 77:21 help 14:16 49:8 65:11, 14 66:15 68:4 76:23 80:9 94:10 helpful 42:17 67:17 Hi 81:20 92:23 hidden 57:3 high 16:16 20:22 21:2 70:15 71:7, 9 72:23, 24 84:13, 16 94:19, 21 95:17 higher 12:4 19:7 71:14, 16 85:18, 19 highest 54:3 70:18 highly 83:19 88:10 Highway 7:3 32:2 43:8 47:8	highways 73:19 Hill 8:20 hills 8:19 hired 101:3 history 93:12 113:6 hit 91:7 hits 21:10 91:2 95:7 hold 1:16 5:4 10:12, 16 holding 77:5 holds 13:19 holistically 89:14 home 79:16 80:22 homeowner 76:5 homeowners 75:25 76:2, 8 homes 73:7 hope 50:6 hopefully 32:12 hopes 94:9 hoping 47:18 68:3 hour 2:24 19:19 102:13 hours 11:16 18:11 19:14, 19 house 89:18 Housing 14:21 huge 30:15 74:4 81:7 108:25 human 60:14 86:2 Humvees 60:21 hundreds 8:5 hydrology 58:10, 16 < I > I-95 8:12 ice 7:15 8:7 14:18 17:10 26:18, 24 27:5 28:4, 11 34:22 71:23 91:13 101:3, 4, 8, 15 102:12, 24 103:12, 13 iced 67:5	ice-melting 29:5 icing 44:14 icy 8:3 76:5 96:5 idea 18:10 47:22 ideally 19:3 95:8 identify 96:16 IHA 47:2 ill 81:8 illegal 30:6 Illinois 77:23 image 3:7 immediately 83:8 immune 83:13 impact 30:11 47:23 76:24 86:2 88:13 89:2, 5, 6 90:3, 23 impacted 86:5 impacts 9:7 62:5 83:10, 21, 23 84:17 impair 62:13 impaired 73:13 impairments 73:14 important 7:13, 16 52:14 87:19 importantly 74:19 improve 63:13 69:21 96:4 98:3 improvements 82:10 improving 17:13 inch 12:9 inches 8:22 incidentally 78:25 include 10:18 88:5 included 2:19 52:3 54:17 66:25 includes 86:22, 23 88:3 including 72:14 74:21 77:13 93:9 96:20	incompetent 76:21 inconsistencies 36:8 Increase 11:5 37:19 43:19 47:4, 6, 10, 17 52:7 53:22 55:23 56:4 62:17 88:5, 8 increased 47:12 52:18 83:9 85:8 86:4, 13, 18 increases 17:20 53:17 84:21 86:15 increasing 38:3 48:25 53:2 55:22 76:25 86:6 87:11 independent 101:4 Indiana 99:20 Indiantown 60:19 indicate 3:4 29:21 individual 80:25 individualized 79:24 81:4 individually 78:12 inextricably 59:11 62:24 infiltrate 54:9 infiltration 62:17 influence 60:14 influx 45:2 information 48:4 67:25 77:12 90:10 91:18, 22 94:11 100:17 114:10 115:22 infrastructure 25:6 30:4 39:8 46:16 48:15 50:9 52:10 56:2 77:3 85:3 95:24 ingest 78:24 ingested 78:23 80:3	ingests 80:5 inhibit 17:3 inhospitable 88:23 inhouse 67:23 106:24 Initially 70:9 initiating 58:12 initiative 41:9 initiatives 40:25 48:19 innovations 65:13 inquired 105:21 Inquirer 2:21 110:18 insects 72:7, 10 84:2 88:24 inside 33:6 insidiously 73:9 insight 67:25 114:10 instantly 76:16, 18 Instructions 2:15 intake 73:3 86:12 Intelligencer 2:22 interest 82:6 114:22 interests 1:18 5:7 63:25 International 8:19 interpret 56:18 interprets 21:25 interrupted 103:25 interrupting 41:18 interstate 19:8 interstates 19:4 invest 108:19 invested 11:6 investment 105:4 107:21 108:15 invite 77:5 invited 5:14 inviting 82:3 involved 115:18
--	---	---	---	---	--

involves 58:16	101:20, 21, 22	lane 19:6, 9,	83:10 95:6, 14	longstanding	low-volume
irregular 67:13	102:8	12 20:19, 23	96:8	93:11	42:14
irreversible	jump 22:7	21:18 75:22,	lift 79:14	long-term	< M >
83:21	jump-starts	24	limit 86:20	59:23 83:10	machine 75:21
irritation	17:12	lane's 75:19	limits 84:22	look 20:2	macro-
79:11	June 61:19	large 61:25	line 8:12	35:15 42:20	invertebrates
ISAIAH 1:10	justify 13:4	78:24 93:19	36:24 106:9,	48:14 50:22	72:8, 10
issue 24:24	juvenile 72:10	larger 10:11	17 107:6, 7, 22,	54:24 56:13	Madam 3:9
27:17 30:17		60:10	25	59:9 60:17	15:10 25:19
35:12, 14 46:3	< K >	larvae 83:25	lingers 84:8, 10	63:5 74:8, 25	51:6 57:10, 19
49:10 51:23	KATHERINE	launched 93:22	link 74:21	77:6 88:2	68:19 77:16
52:16, 18	1:11	Laura 58:3	links 67:2, 22	102:11, 23	81:16 92:7
64:15 67:15	keep 7:17	law 2:7	77:13	105:16 106:17	99:2 115:14
68:2 95:5	62:7 63:10	lawsuit 38:4	liquid 12:16	107:24 108:15	mag 25:4
issues 23:9	65:10, 21 87:5	lay 18:9	24:23 25:4, 11	looked 54:18	magnesium
27:13 29:25	keeping 14:17	laying 24:20	26:17, 23	looking 37:25	23:6, 7 24:23
30:5 33:12	28:25 65:12	layman's	27:10 104:23	42:22 47:2	78:20 88:24
34:18 35:8, 22	71:9 95:2	44:20 108:15	108:17	48:24 49:5	main 7:24
36:5, 7 37:11	KENDRA 1:11	leach 95:24	listened 108:22	52:4 53:24	32:20 33:2
42:22 46:18	Kennel 77:25	leaching 86:18,	listening 29:24	65:14	34:15
50:9, 11, 12, 13	kept 24:2	20 89:7	40:21 46:11	looks 38:8	maintain 32:6
52:9, 10 66:10	75:21	lead 61:24	104:2, 10, 11	loop 18:13	39:23 40:14
78:15 79:10,	kills 62:18	85:2 86:16, 17,	112:6	Lorenz 7:3	42:11 97:20
22 80:14	kind 31:11	18, 20 89:7	liter 60:2, 6,	31:2, 24 32:2	98:20 100:24
87:24 112:23	90:11	95:24	12, 15, 24 62:7	33:3, 16 36:14	103:7
items 50:15	Klein 77:20,	leadership	little 23:18	43:5, 8 44:2	maintained
its 8:9 22:23	21, 22	88:2	36:12, 19	lost 46:21	29:6
61:9 62:23	know 16:13	League 93:3,	44:22 45:7	lot 18:8 20:11	maintaining
80:8 106:3	20:13 24:17	11, 19, 22 94:8	73:15 92:13	23:12 29:25	17:23 98:22
111:3	36:23 38:25	96:14	101:22 104:17	33:25 36:20	maintenance
Izaak 69:24	39:12 42:5	League's 69:24	105:8 106:15	49:11 59:7	11:3 15:21
93:2, 3 94:8	44:10, 20 45:9	learn 67:18	110:12 111:18	85:4 87:9	27:18 47:8
96:14	46:20, 21	learned 71:2	live 27:23	88:10 91:15,	108:5
< J >	48:13 49:13	lease 38:21	67:11, 16	18 113:14	major 44:13
Jackson 51:10,	56:24 59:8	leaves 85:9	69:12 72:8	115:21	72:12, 24
13, 16, 17 66:5	65:8, 10 66:2	leaving 83:14	77:22 82:24	lots 54:15	73:14, 19
71:14 75:2	90:17 91:7	left 91:11	lived 27:24	55:7 70:24	86:25
Jana 25:22	103:19	93:20	living 28:2, 7	75:3, 9, 10, 11,	majority 78:23
26:6	known 11:16	left-hand 101:7	78:11	16, 18 82:13	making 75:11
January 36:22	23:12 53:2	Legal 2:21	lo 109:6	87:19 97:21	106:24 113:10
110:18	72:8	lessened 27:17	load 24:8	love 84:5	114:20
Jeff 82:21	KRAFCZYK	lethal 83:8	loaded 94:5	90:16 91:4	managed 75:7
Jerry 77:20, 22	15:18, 19	lets 31:13	loads 106:5,	112:9	Management
John 15:13, 15,	30:21 33:20	level 12:4	14 107:18	low 10:8	10:16
19 30:19	43:17	19:8 35:17	local 10:23	12:21, 22 20:4	Manager 26:6
31:22 33:19,	K-Tech 99:19	82:9 100:24	26:22 30:3	21:2 23:17	Managing 14:3
20 42:8 43:17	< L >	levels 61:2	47:19 48:8	25:3 95:9, 19	manifesting
47:11 51:10,	laboratory	62:9 70:8, 10,	58:17 94:12	110:23	79:13
17 58:22	52:4 101:4	14, 19 71:7, 9,	96:10 97:24	lower 8:25	manpower
60:11 61:5	Labradors	13 72:5 73:2	location 35:9	12:20 24:6	17:22
62:3 64:20, 21	80:17	82:21 83:20	locations 7:25	27:4 97:2	manually
66:4	laid 31:16	93:21 94:22	54:2 60:5	109:4, 8	38:24
Johnson 4:9	lakes 95:8	95:10 98:14	logic 100:21	lowering	manufacture
joined 29:14	96:9	103:7	103:11 105:14	17:22 18:25	16:7 99:22
juice 12:12, 13,	lame 79:14	liability 66:10	long 24:16	89:5	manufactured
19, 23 13:3, 6,	land 90:25	lick 79:2	59:10 61:6	lowers 18:20	23:19 105:10
10, 14 56:9	109:7	life 13:7	62:2 75:16	20:3	110:21
88:6, 18	landlords 75:7	24:17 25:7	106:10	lowest 88:8	
		31:17 62:5, 13	longer 27:10		

manufacturing 110:20	member-based 93:4	milligrams 60:2, 3, 6, 12, 15, 24 62:7	month 36:22, 24 70:3, 6	necessarily 50:2 64:11	note 2:24 5:25 29:12
map 111:16, 17	Members 3:3	million 94:20, 22 95:11, 14	monthly 70:12	necessary 88:7	noted 52:16
March 1:7	5:23 6:4, 23	96:10	months 84:12	108:7	54:14 55:11
2:4	26:4 29:11, 17	mimics 33:22	98:14, 18	need 11:22	87:8 89:11
MARK 1:12	40:21 45:21	minded 85:16	morning 3:12	13:10 38:6	notes 117:6
market 22:12, 15	49:16 63:19, 21 68:11	mindful 7:12	mortality 85:18	40:13 60:21	notice 59:6
Maryland 56:14 67:2	69:10 82:5	9:12 82:20	Mount 69:12	63:2 86:19	notices 2:20
93:20	92:3, 8 104:6	88:14	74:7	87:15, 21	novel 83:16
Master 69:16	112:15 113:18, 24 114:2, 24	mineral 87:16	mountain 8:16	88:14 89:15, 20 100:23	number 16:2
material 17:16	115:17	minimize 9:23	mountains 67:5	103:6 108:3	17:2 22:11
23:14, 21 81:2	mention 76:13	Minnesota 54:18	move 57:22	110:8 111:24	24:25 30:13
88:19	mentioned 10:18 22:9	minute 30:10	64:4 91:4	113:7	32:16 34:14
materials 23:25 42:23	60:11 61:5	38:22	113:15 114:14	needed 12:23	39:25 40:13
43:3 49:24, 25	62:3 73:5	minutes 102:25	moved 14:8	13:9 76:23	41:11 49:2, 9
100:3 110:20	75:3 105:9	mission 93:6	21:4	97:15	79:21 84:2
mathematical 103:11 105:14	metal 9:7	mistake 74:13	moves 31:11	needs 13:12	86:6 96:20
matter 117:7	metals 62:12	mistakenly 75:10	moving 7:18	18:21 19:16	97:6, 18 98:5
maximize 87:25	95:25	misunderstandi ng 18:18	MS-4 10:20, 21 13:20, 22	39:21 76:10	109:11 112:22
mean 9:22	meteorologists 8:11	mitigate 59:3	14:2	neighbor 80:23	numbers 28:20 61:4
22:20 56:7	meters 44:25	mix 25:8	Muddy 93:20	neighborhood 74:7	106:16
81:9	method 24:5	101:21 102:20	mug 76:6	neighbors 89:16, 21	numerous 83:16
meaning 18:12	50:16 100:15	107:9 110:3	98:9	net 107:19	nutrients 88:19
means 30:21	103:10	107:9 110:3	multiple 115:2	network 19:11	< O >
55:24 60:9	methods 30:12	mixing 109:24	Municipal 10:21, 23 55:6	networks 19:7	objections 117:4
72:22 78:5	50:7, 24 108:5	mixture 11:14	66:19	never 32:17	observed 52:7
98:14 106:3	metro 94:16	mobilizes 62:12	municipalities 54:20 55:10	57:2	53:4 83:23
107:16 108:16	metropolitan 71:5	model 63:8	71:19 85:24	New 56:14	observing 53:10
117:23	MICHELE 117:15	modern 93:17	MURPHY 117:15	65:13, 22	obvious 60:16
measure 59:20	Microsoft 1:6	moisture 18:24 21:7	mute 99:12	66:12 67:11	Obviously 73:18 85:22
medical 78:15, 16 79:9, 10	2:14 6:3	31:20		newer 26:25	occurred 8:8
80:9	Mid-Atlantic 26:8, 9 32:22	molasses 22:10, 22	< N >	News 2:21	56:16
medium 10:8	33:7, 13	moment 102:15	name 3:5	81:5	occurrence 12:21
21:2	middle 102:2	monarch 85:14	6:18, 24 15:15, 19 25:24 26:5	newspaper 110:14	occurrences 80:12
meet 39:18	mighty 18:24	money 105:15	31:25 51:12, 13, 17 57:15	next-door 80:23	occurring 95:11
93:16 111:11	mile 16:14, 17	107:11 108:2, 7 114:15	69:4, 7, 11	nine 109:15	ocean 8:16
meeting 2:13	20:19, 23, 25	monitor 61:13	81:21 92:21, 24 99:7, 15, 18	no-brainer 112:5	71:12 82:23
5:15, 20	21:18, 19	69:24 70:5	115:4	non-existent 79:18	OEM 14:20
111:12	mileage 37:19	71:13	named 70:2	nonsense 105:20	offer 2:16
melt 11:25	38:3	monitors 70:2	nation 62:21	53:8 71:14, 16	115:5
12:8 18:19	41:10 42:2	71:3	national 93:4	76:17	Office 10:15
22:23 27:5	46:13 47:14, 25 49:3	Montanez 6:16, 21, 24	94:5	north 34:16	14:3 39:19
28:4, 11 54:10	106:10	30:18, 23, 24	natural 22:21	52:21	41:23 77:24
71:23 101:3, 5, 15 102:12	military 60:20	39:14, 16 40:2, 7, 12 41:4, 14,	60:13 74:18	Northeast 8:22	Officer 77:24
103:13	milkweed 85:15, 20	19 46:23, 24	75:14 87:5	Northeastern 87:23	offset 16:25
melted 101:9		48:6 51:4	93:8	Northwest 8:23 22:16	oftentimes 17:9
102:24			naturally 95:11	nose 106:8, 11	OH 1:12 3:22, 23
melting 17:12			near 14:11	notably 93:13	
melts 18:19			nearby 84:22		
103:11					
member 25:20					

Okay 37:6, 17 38:7 39:6 40:9 43:14 58:8 92:12 99:18 100:19 101:10, 13, 20 102:24 103:17, 18 104:24 105:4 108:19 110:5, 25 111:22 older 39:4, 8 67:15 once 15:8 25:17 28:9 31:14 104:2 107:8 ones 91:11 ongoing 84:14 online 74:25 open 15:9 29:10 112:14 operation 44:19 operations 7:10, 20 11:20 12:12 13:11 44:12 82:11 opinion 44:3 68:17 opportunities 47:3 opportunity 14:15 48:17 89:25 100:4 options 50:7, 24 112:23 order 1:17 4:20 5:7 6:5 40:13 89:19 organic 88:19 105:10, 15 organic-treated 104:19 organization 93:5, 6 109:2 organizations 59:14 original 53:8 103:5 ought 76:15 outlines 104:8 outside 30:6 33:25 55:14 69:22 90:19 93:19 overall 52:25	over- application 74:12 overapplied 74:13 overlap 76:3 overnight 34:21 over-salting 86:2 90:4 overseeing 44:12 overuse 82:20 88:15 owner 78:10 owners 89:13 oxygen 88:22 109:17 < P > p.m 1:7 116:3 Pacific 22:16 pack 17:3, 5, 7 pads 79:12 page 40:11 100:20 101:2 103:8, 22 104:16 105:21 106:15 108:13, 20 110:11 111:15 pages 104:5 palatable 80:18 pallets 24:19 pandemic 35:21, 24 panel 15:7, 8, 11 25:17, 20, 22 29:19 49:17 50:21 51:8, 10 57:11, 25 63:21 68:12, 20, 23 77:18 81:17 91:16 92:2, 5, 9 99:3, 5 112:17, 22 113:2 114:2, 8 115:10 Parking 14:22 55:7 70:24 75:3, 11, 16, 18 82:13 87:18 97:21 Parks 7:25 14:21 84:21 Parkway 74:6	part 32:20 52:7 56:20, 21 113:2 participants 5:18 participation 115:11 particles 18:24 particular 24:17 29:19 49:17 64:15 68:12 77:17 84:25 92:5 112:17, 22 parties 54:16 partner 13:25 70:2, 6 114:11 partners 14:16 91:24 partnership 66:14 69:20 parts 33:10, 11 94:20, 22 95:10, 13 passable 76:16 passed 53:17 passing 53:23 patcher 38:21 pathogens 83:14 patients 78:9 pave 32:10 38:6 paved 49:2 pavement 16:24 20:20 34:22 35:4 91:6 pavements 16:5 paving 32:7, 15 37:10, 12 38:17 39:22 40:16 41:8 42:3, 4, 10, 15 46:14 47:4, 13 48:8 91:8 paws 79:2, 13, 14, 15 80:6 pay 73:11 75:8 peak 62:8 peaks 60:11 penetrate 31:13 35:4 Penn 59:15 61:14 69:17 81:22, 23 82:4 90:2	PennDOT 15:13, 22 22:12 33:21 34:2 43:17 47:12 73:20 74:24 Pennsylvania 1:6 13:20 14:23 52:20 60:19 110:17 111:20 Pennsylvanians 81:25 Pennypack 55:12 58:18 82:25 people 29:2 30:7 33:25 35:25 54:15 55:18 56:25 63:5 66:6, 19 73:2 75:9 79:19, 25 86:10 90:16 95:17 105:13 111:25 112:6, 21 percent 16:9 21:22 22:6 27:25 28:7 38:10, 11 41:7 43:16, 18 55:2 67:4, 9 94:18 101:16 102:3, 7, 12, 24 103:12, 14, 15 104:20, 22 105:2, 4, 18 106:2 107:15, 17, 21, 25 108:7, 14, 23 109:14, 16, 25 110:2, 4 percentage 43:16 perception 76:13, 24 performance 101:24 102:5, 23 103:4 107:13, 16 111:5 performed 70:18 performing 7:9 performs 100:23 102:12 period 27:21 28:15 101:9	periods 12:22 34:19 permeable 61:21 permit 10:20 13:20, 22 14:2 perspective 50:4 51:22, 23 55:8 56:9, 10, 17 63:22 68:8 pertains 10:20 pet 90:15 Peterson 70:7 pets 90:12, 16, 19 pH 89:5 phenomenal 90:10 PHILADELPH IA 1:2, 6 3:19 7:21, 23 8:9, 18 14:20, 22 31:7 38:13 45:9, 25 47:9, 16 52:15, 17 55:15, 16, 17 59:18 64:3, 14, 24 67:14 69:13, 22 71:5 74:5 76:5 82:6 85:2 86:17, 24 90:17 94:16, 25 105:23 110:14, 18 112:24 113:4, 10 114:12, 22 Philadelphians 72:21 76:14 85:16 Philadelphia's 1:17 5:6 62:14 86:21 90:4 Philly 8:21 90:14 philosophy 9:19 PHLCouncil.co m 2:23 photographs 74:4, 10 77:6 pick 107:2 picked 32:13 pile 104:17, 20 piles 75:22 pilot 23:10 pinpoint 94:12 pins 111:18	pipes 73:5 86:15, 16, 21 95:25 place 19:23 27:20 34:7 50:15 60:17 73:8 91:5 places 53:10 plain 18:3 23:15 plan 11:21 19:5, 10 planning 18:8 47:13 plant 84:24 85:5, 9 planting 85:17 plants 62:16, 18 65:18 72:3, 17 82:24 84:23 85:7, 12, 15 95:20 96:12 98:17 players 54:21 please 2:25 3:4, 6 4:24 6:8, 10, 18 15:15 25:19, 24 29:21 32:25 51:7, 12, 13 57:10, 15, 25 68:19 69:4 74:7 77:16 81:16 92:20 99:2, 6, 15 114:18 plowed 76:18 plowing 19:20, 21 87:13 plumbers 39:6 pockets 61:24 point 18:12, 14, 20 19:2 20:3, 8 27:5 39:15 40:15 53:21 111:24 pointed 39:20 109:12 Police 14:22 policymakers 94:8 pollution 30:2 93:18 94:3, 12 95:3, 5 97:4 poor 91:10 pops 31:14 population 72:13
--	--	---	--	--	---

populations 83:14, 18	Preston 99:5, 11, 13, 18, 19	problems 49:12 93:17	provide 72:11 91:22	21 42:19 45:18, 21	65:19 66:5
Poquessing 87:4	100:14 103:21	94:12, 14	provided 100:12	49:15 63:18	90:8, 16 91:14,
poses 86:9	104:3, 12, 14	proceed 51:14	provides 21:7	68:10 92:4	16, 19 108:15
position 36:12	pre-treat 12:7	proceedings 117:4	59:22 84:12	112:10, 16	110:7, 8
49:7 50:17	Pre-treating 16:4	process 17:12, 13	providing 14:16 68:17	113:24 114:24	reason 18:15
114:20	pre-treatment 97:15	processes 15:24	public 2:10, 11, 16, 17, 19	quick 34:21 46:10	101:17
possible 2:15	pretty 17:16	product 22:20	4:21 5:16, 17	quicker 21:11	reasonable 5:19
8:20 14:9	21:2 33:22	96:22 97:2	26:7 63:6	quickest 9:4	reasons 8:13
47:17 50:19	34:17 36:23	101:6 102:9,	86:7 94:7	quickly 14:9	13:5
51:3 113:12	44:21	17 107:8, 9	96:2 98:6, 22	25:10 98:3	recipe 1:17
possibly 42:25	prevalent 26:13 27:17	108:10 109:8, 11, 14, 23	117:16	quite 59:3 77:8	5:6
post-pandemic 113:7	36:2	110:3	published 2:20	quorum 4:19	recognize 23:16 52:8
potassium 23:7 78:20	prevent 17:3	products 22:11, 15, 24	pulse 88:18	quote 105:7 110:12, 16, 19	57:3
pothole 30:17	Prevention 34:23	23:6, 19 105:6	pulses 83:4, 19	< R >	recognized 6:5
31:18 33:12	previous 36:20, 21	112:2, 4	purchase 11:22 107:9	rain 8:7, 21	29:23
35:14 38:21, 22 39:5	94:25	professor 58:9	purchasing 11:7, 9	11:17 18:2, 3	recognizes 46:7
potholes 30:9, 13 31:4, 5, 19	previously 28:24	16 34:24, 25	pure 105:20	34:20 71:24	recognizing 5:23
32:6, 17, 18, 21	pre-wetting 20:17 21:5, 15, 20	37:10 38:18	purpose 6:7	rain/snow 8:12	recommend 64:2, 16 67:21
33:2 34:10, 16	price 38:9	42:15 62:14	purposes 43:23	rains 70:25	recommendatio n 43:22
35:5 38:24	primarily 52:23 56:11	66:13 69:25	pursue 13:5	ramps 38:7, 9, 11	recommendatio ns 113:14
pounds 20:18, 23, 25 21:17, 19 22:2, 3	primary 12:5 101:17	76:11, 22 85:4	push 111:18	range 79:25	recommended 40:17 42:4
71:20	prior 2:22	93:2, 14, 23	put 12:16 18:8 19:17	ranging 8:7	recommending 40:24
practices 35:11 94:14	5:22 10:2	96:17	36:11 40:15	rare 12:20 80:11	recommends 62:6
96:20 98:4	11:16, 17 16:5	programs 81:24	41:25 42:3, 12	rate 21:17	record 5:25
precipitation 13:17	63:24 77:25	progress 9:17	44:17 49:6	105:18 106:2	6:19 15:16
precise 21:3	Prisons 14:23	prolonged 95:15	50:15, 17	107:17	25:25 29:12
predict 62:25	privacy 5:19	promote 93:7	61:15 65:12	rates 16:11	51:14 57:16
predicted 97:13	private 54:20	prone 33:13	75:8 102:10	20:17, 21	69:5 92:21
preferred 24:5	55:6 56:2	proper 11:3 27:18 65:9	104:9 106:7, 11 109:4, 20	21:14, 18	99:7, 16
prepare 48:22	66:6, 7 89:12	properly 29:6	114:19	ratio 42:23	recorded 5:16, 21
64:17	91:23 97:22	property 56:2	putting 17:17	43:3 64:6	Recs 7:25
preparing 110:15	98:2	75:7 89:12	32:15 45:4	ratios 43:11	14:21
presence 45:23 115:12	proactive 11:12	97:22 98:8	98:15 102:4	raw 22:23	rectified 79:15
PRESENT 1:7	probably 34:12 66:20	proportion 81:7	107:4 108:10	reach 30:8, 16	rectify 80:9
3:5, 13, 24 4:6, 17, 19 7:5	problem 33:14	proportions 55:4	PWD 13:10, 19, 25 14:18	read 4:25	red 79:13
26:9 29:14	35:18 37:9	protect 14:10	PWD's 11:2	110:13	107:23
113:17 115:3	39:3, 10 52:18, 20 53:15 55:9	97:3 98:19	< Q >	110:13	reduce 21:16, 19, 21 32:17
presentation 109:21 111:10	56:21 59:2	protecting 9:15 86:22	quality 93:17	110:13	55:21 82:11
112:9, 13	62:11, 20 63:2, 11 64:22 68:5	96:19	96:7	readily 22:18	87:17 88:7, 25
presents 8:10	74:11 75:2	Protection 13:21	quarterly 59:13	readings 94:19, 21	89:17 97:12
preserve 90:25	79:8 91:3	protocols 70:21	quarts 76:7, 8	ready 11:13	100:15 103:10
pressure 72:24 76:25	95:17 108:25	proven 24:12 110:23	question 29:24 46:10	109:15	106:3 109:13
86:11 95:18			questionable 25:7	ready-made 11:23	reduced 67:3
			questions 5:23 15:3, 9 25:14, 17 29:11, 18,	real 63:8 67:16	97:17 98:13
				realistic 49:9	105:25
				really 36:12	reduces 88:21
				46:20 49:10	
				52:11, 21, 22	
				53:19 55:17, 20 59:22	
				63:11 64:22	

reducing 17:2 22:5 105:17 106:12	34:24 38:11 repeat 32:25 replacing 11:8 replicate 36:10 report 41:25 reporter 117:25 reporting 47:21 48:3 represent 82:5 104:19 represents 107:25 reproduction 117:22 require 14:6 23:20 25:5 70:19 95:19 requirements 38:5 requires 2:8 requiring 80:9 RES 2:1 3:1 4:1 5:1 6:1 7:1 8:1 9:1 10:1 11:1 12:1 13:1 14:1 15:1 16:1 17:1 18:1 19:1 20:1 21:1 22:1 23:1 24:1 25:1 26:1 27:1 28:1 29:1 30:1 31:1 32:1 33:1 34:1 35:1 36:1 37:1 38:1 39:1 40:1 41:1 42:1 43:1 44:1 45:1 46:1 47:1 48:1 49:1 50:1 51:1 52:1 53:1 54:1 55:1 56:1 57:1 58:1 59:1 60:1 61:1 62:1 63:1 64:1 65:1 66:1 67:1 68:1 69:1 70:1 71:1 72:1 73:1 74:1 75:1 76:1 77:1	78:1 79:1 80:1 81:1 82:1 83:1 84:1 85:1 86:1 87:1 88:1 89:1 90:1 91:1 92:1 93:1 94:1 95:1 96:1 97:1 98:1 99:1 100:1 101:1 102:1 103:1 104:1 105:1 106:1 107:1 108:1 109:1 110:1 111:1 112:1 113:1 114:1 115:1 116:1 research 51:17, 19, 20 58:15 researchers 94:7 residential 42:13 residue 13:13 71:24 RESOLUTION 1:12 5:2 6:14 7:6 resolving 80:8 resource 68:4 90:3 114:13 resources 1:18 5:9 46:16, 17 49:8 74:18 75:14 93:8 98:19 responding 3:7 response 4:10, 13 49:18 57:18 68:13 83:13 92:6 99:9 112:19 113:22 114:5 115:7 responsibility 13:23 responsible 10:24 37:15 54:15 55:6 rest 8:25 111:21 restore 93:7 result 8:3 96:2	results 17:21 56:18 83:5 94:17, 18, 24 101:3 retail 75:3 rethinking 87:7 retired 69:14 retirement 69:16 retrofit 11:10 13:9 return 105:3 107:21 108:14 revenue 41:7 review 13:11 59:17 73:17 revisit 57:5 Rich 6:16 16:4 22:9 30:22 39:12 Richard 6:24 30:24 39:16 46:24 RICHARDSON 1:11 4:12 29:13 right 22:7 24:4 37:24 38:8 45:17 53:5 64:6, 25 67:19 68:6 70:12 74:5 84:9 85:6 100:16 101:12, 14 102:14, 16 103:21 104:21, 25 106:14 109:19 111:16, 17, 20, 22 rinsing 79:15 riparian 72:3 rise 20:7 58:22 60:10 risk 86:10, 20 River 8:14, 24 9:2 45:10, 11 52:3 83:2 85:23 rivers 9:9 13:24 52:17 72:19 82:17 86:5 road 7:17 11:15 12:2, 4 17:18, 19 31:17 52:23 53:14 54:11	55:5 58:13 59:22 60:16, 18 61:3 65:17 67:3, 13 74:14 86:4, 14, 23 87:7 93:18 94:2, 13 95:3, 7 96:4, 16, 23 97:7, 14 98:6, 11, 17 roads 1:18 5:8 10:2 19:12 22:18 26:18 29:2 34:4 42:5, 9, 24 47:15, 19 49:2 55:5, 7 60:22 65:16 70:23 71:25 73:9 76:15 82:15, 16 84:19 87:18 97:21 road's 28:25 roadway 10:11 17:4, 10, 14 19:2 21:9, 10 32:11 roadways 7:8 9:4 12:5, 8 14:17 18:6 22:21 26:15, 25 28:5, 12 32:6 33:6 73:19 85:6 robins 72:15 robust 94:9 rock 20:16 22:5 26:17, 23 34:7 56:8 67:8 69:21 70:7, 14 71:19, 21 98:9 100:22 101:8, 11, 13, 16, 18, 23 102:4, 6, 10, 13, 22, 25 103:5, 14 104:19, 21, 24 105:22 106:6, 10 107:19 108:5, 10 110:5, 24 role 63:8 roles 70:4 roll 2:25 roof-enclosed 24:15 rotten 13:16	roughly 16:14 19:5 round 71:10 84:13 routes 18:9 RPR-Notary 117:16 runoff 62:15 88:20 93:22 runs 10:19 rural 19:12 rust 26:20 27:13 28:10, 14 rust-related 28:16 < S > safe 1:18 5:8 7:15 22:21 26:15 29:2 64:8 76:6 86:8 98:20 safer 74:15 75:11, 17 safest 43:24 safety 7:16 28:25 87:10 96:5, 18 98:22 salamanders 83:15 saline 88:10 salinity 82:23 83:9 84:22 Salt 1:16 5:5 7:7, 12, 20 9:3, 7, 10, 18, 19, 21, 24 10:12, 17, 19, 20, 25 11:4 12:3, 16 13:2 14:5, 6, 11, 12 16:7, 9, 11 17:17 18:16, 19, 20, 21, 22 19:16, 21, 22, 25 20:3, 6, 9, 16, 19 21:6, 7, 8, 9, 12, 13, 15, 21, 24 22:5 23:15, 17 24:2, 11 25:8 26:11, 17, 23 27:2 28:3, 10, 21 29:5 30:2 34:2, 5, 7 36:4 43:12, 13 44:4, 16, 22 45:2, 8 51:22 52:4, 7, 19, 23, 25
---	---	---	--	---	---

53:14, 24 54:5, 11, 19 55:2, 21 56:6, 7, 8, 9, 11, 15, 22 58:22 59:22, 25 60:16, 18, 21 61:3, 7, 17, 25 62:4, 7, 11, 15, 17 64:6 65:4, 6, 15, 18 67:3, 7, 8, 9 69:25 70:2, 5, 8, 17, 22, 25 71:3, 7, 12, 20, 22 72:16 73:3, 5, 13, 16 74:4, 12, 15, 16, 19, 20 75:8, 9, 10, 15, 17, 23 76:2, 4, 7, 9 78:19 79:11 80:13, 18 82:9, 12, 14, 20, 21 83:4, 7, 20, 25 84:8, 13, 16, 19, 23 85:10, 19, 20 86:4, 7, 12, 14, 23 87:7, 16, 21, 24 88:7, 17 89:12, 17, 18, 22 93:18, 19, 21, 22 94:2, 4, 13 95:3, 4, 7, 9, 12, 16, 21, 23 96:4, 6, 13, 15, 16, 21 97:6, 7, 8, 10, 16, 22, 25 98:6, 9, 11, 18 100:22 101:9, 11, 13, 17, 18, 23 102:4, 6, 10, 12, 13, 22 103:2, 6, 11, 12, 13, 14 104:17, 19, 21, 24 105:17, 22 106:3, 6, 10, 19 107:19 108:5, 11 110:2, 5, 22, 24 salted 73:20, 23 76:19 salting 9:25 10:3 73:10 82:10 salt-related 28:14 salts 58:13 89:3 96:23	saltwater 11:14 61:11 salty 71:12 72:2 Samantha 92:18, 25 sample 93:25 sampling 52:2 58:16, 20 59:14 sand 87:16 Sanitation 14:19 Save 93:13, 15 108:18, 19 savings 105:17 106:19, 20 107:19 saw 23:13 36:19 78:7, 8 saying 33:11 36:2 38:16 50:2 says 105:2, 3 106:17 107:24 110:19 scenarios 8:6 scenes 115:20 School 69:15 Schuylkill 8:24 45:11 72:18 83:2 science 20:13 69:14 Scientist 51:20 scope 89:10 screen 3:8 sealed 35:2 season 13:8 48:23 49:22 94:24 114:14 seasons 70:13 second 51:10 52:13 section 69:13 107:15 see 13:12 19:18 30:13 33:8 34:18 35:15 37:20 41:23, 25 45:2, 18 47:3, 9 54:3, 5 55:22 60:5 61:10 63:2, 18 65:3 74:9 84:6, 24 85:25 101:14 102:4 104:25	107:15 111:17 113:16 seeing 35:24 37:6 47:16 57:4 58:24 68:14 83:9 seen 42:21 53:12 62:9 66:11, 18 99:11 100:7 seep 27:11 sees 31:7 Selling 57:13 68:23, 25 69:7, 8, 12 semi 106:5, 14 107:18 semis 106:7, 9 Senior 15:20 51:20 sensors 44:25 61:15 97:8, 12 separate 10:16, 21 23:20 25:10 SEPTA 7:24 September 94:19 serious 27:14 80:14 seriously 73:13 serve 113:9 Service 26:5 45:24 97:21 100:24 103:7 SERVICES 1:3, 16 2:5 4:22 5:4 6:23 14:18 15:24 30:6 69:11 115:13 116:3 set 112:18 setting 10:9 seven 27:22 102:5 107:5 seven-year 42:10 Severe 102:18 Sewer 10:22 shame 84:25 share 48:5, 8 100:4 shared 82:21 84:8 shelf 13:7 24:16 25:7 shifted 26:23 Shih 80:4	shockingly 70:15 shoot 19:14 shopping 75:5 short 10:21 shoveling 76:3 show 59:24 62:4 101:7 103:23 shown 88:6 side 47:23 50:10 101:7 sidewalk 76:6 98:10 sidewalks 41:12 70:24 76:4 79:3, 5 82:12 87:18 significant 23:13, 23 34:13 56:15 66:10 91:3 95:5 significantly 17:6 105:11, 19 107:11 110:24 signify 6:4 silage 12:15 similar 16:3, 18 38:19 83:23 96:2 simple 98:2 100:21 103:10 105:13 simply 75:8 82:8 104:23 sinks 73:6 sir 40:8 41:15 site 94:5 sites 52:2, 6 six 8:22 Sixty-four 102:24 size 80:2, 4 sleet 17:25 slide 16:21 slide-in 16:20 slight 47:5 slipping 87:17 sloppy 74:2 slow 59:5 slowly 20:7 61:22 73:8 small 31:12 75:15 smell 13:16 snow 7:8, 14 10:3 11:18, 24	12:9, 10 13:15 14:18 17:3, 5, 7, 25 18:19, 20, 22 19:5, 9, 12 20:19, 23 21:17 22:23 23:12, 13 26:18, 24 27:5 28:4, 11 29:4 34:8 36:25 37:4 44:12, 13 54:10 67:11, 12 71:23 76:2, 15 91:13 Snowfighters 22:16 snowing 8:21 snowplow 97:19 snows 59:8 snowstorm 27:4 snowy 67:5 sodium 23:4 78:19 85:8 89:2 95:19 96:24 101:19 102:20 soil 61:9, 20, 22 65:17 84:22 93:9 solution 16:9 18:21 20:6 21:10 55:9 56:22 63:3 solutions 31:15 55:20 63:5 65:22 87:9 88:9 solve 64:23 songbirds 72:14 84:6 soon 48:7 65:23 sorry 7:22 27:20 32:24 33:3, 16, 19 41:18 46:6 58:5 92:13 104:13 sort 25:5 106:5 source 54:25 72:12 86:22 sources 56:7 59:13 South 8:21 Southeast 52:20	space 87:2 91:5 spaces 41:2 87:5 90:25 speak 15:23 47:11 special 12:6 specialize 58:10 specialized 70:20 specialty 78:8 99:20 species 9:11 specific 25:13 speeds 76:17 spend 20:11 41:8 108:4, 17 114:16 spending 108:3, 6 spill 93:19 spills 74:5 sponsor 109:3 spray 16:21 21:24 sprayed 21:8 spraying 21:23 spread 11:4 spreaders 10:6 97:7, 9 spreading 10:7 44:16 71:20 spreads 87:16 spring 61:12 84:11 98:12 squares 98:10 SQUILLA 1:12 3:10, 11 staff 93:22 stand 111:3 standards 74:17 standpoint 110:7 start 10:2 11:25 13:16 29:20 32:15 43:6 55:14 56:19 64:25 99:23 started 52:14 53:9 starting 18:3, 14 starts 10:4 18:12 100:20
--	---	--	---	--	--

state 2:7 6:18 15:15 25:24 26:21 39:23 40:14 42:9 47:15 48:16 49:7 51:12, 13 54:20 55:6 57:15 66:14, 18, 20 69:4, 17 92:21 97:23 99:7, 15	stormwater 54:9 61:13, 16 62:15, 18 strategies 63:12 96:21 stream 51:18 54:12 59:19, 20, 21 61:10 71:17 82:2 93:21 98:13 Streamkeeper 69:18 70:5 streams 1:18 5:8 9:8 13:24 52:17 53:2, 6 58:17, 20 61:25 62:6, 10 65:4 71:11 72:2 77:2 82:7, 8, 25 84:3, 11, 18 87:3 88:23 93:13, 15 95:9 96:9, 11, 17 street 7:11 13:15 37:16 38:6 41:8 45:5 46:18 73:24 74:16 79:6 82:10 91:6 STREETS 1:3, 16, 17 2:1, 5 3:1 4:1, 22 5:1, 3, 6 6:1, 15, 23 7:1, 2, 4, 14 8:1 9:1, 15 10:1, 8, 14 11:1, 19 12:1, 4 13:1, 24 14:1, 19 15:1 16:1 17:1 18:1 19:1 20:1 21:1 22:1 23:1 24:1 25:1 26:1, 5 27:1 28:1 29:1 30:1, 5, 25 31:1 32:1, 3, 13, 14 33:1 34:1 35:1 36:1 37:1, 15 38:1, 12 39:1, 17, 21 40:1, 16 41:1 42:1, 14 43:1, 9 44:1 45:1, 4 46:1, 25 47:1 48:1	49:1 50:1 51:1 52:1 53:1 54:1 55:1 56:1 57:1 58:1, 14 59:1 60:1 61:1 62:1, 14 63:1 64:1 65:1 66:1 67:1, 14, 16 68:1 69:1, 10 70:1 71:1 72:1 73:1, 22, 23 74:1, 24 75:1 76:1, 18, 20 77:1 78:1 79:1 80:1 81:1 82:1, 12, 19 83:1 84:1 85:1, 22 86:1 87:1 88:1 89:1, 23 90:1 91:1, 9 92:1 93:1 94:1 95:1 96:1 97:1 98:1 99:1 100:1 101:1 102:1 103:1 104:1, 7 105:1 106:1 107:1 108:1 109:1 110:1 111:1 112:1 113:1 114:1 115:1, 13 116:1, 2 strength 52:11 stress 84:14 98:15 strips 93:24 Stroud 51:19 structure 14:7 structures 14:9, 11 struggling 57:20 stuck 90:8 91:12 studies 22:14 23:10 62:4 study 28:21 stuff 24:20 subject 22:25 80:25 submitted 94:16, 18 104:3, 6 submitting 74:4	suburban 73:22 75:18 suburbanites 76:14 suburbs 65:3, 5 successive 94:10 sugar 12:13, 14 summer 54:4, 5, 13 61:12 70:16 71:15 84:12 98:14 sun 12:25 Sunday 31:8 Sunshine 6:6 super 100:18 supermarket 75:24 supervision 117:24 supply 61:25 72:19 89:8 support 7:21, 22 82:10 sure 7:14 40:10 50:18, 25 57:24 89:20, 22 113:10 114:18, 20 surely 111:10 surface 11:15 12:17 17:14 67:13 surfaces 10:11 surplus 48:17 survey 27:19 59:18 survive 72:3 suspended 16:9 sustainable 93:7 swear 67:11 System 10:22 47:8 systems 20:24 23:21, 22 27:16 45:14 < T > tadpoles 83:12, 22 tail 106:8, 11 tailoring 96:21 take 3:2 17:5 30:10 64:18 65:15, 20	78:13 101:20 107:23 112:9 takeaway 87:20 taken 74:5 117:6 takes 73:8 talk 30:11 44:14, 23 103:3 105:5 111:24 talked 16:4 35:10 38:15 58:23 73:15 110:12 talking 99:12 103:9 106:12 109:22 112:22 tank 27:15 tanker 16:19 tanks 11:10 16:20 tap 68:3 82:2 targeting 66:6 tarps 14:13 Task 14:4 tax 76:21 taxpayers 1:19 5:10 teach 63:6 teacher 69:14 team 115:15 Teams 1:6 2:14 6:3 technology 87:14 112:7 teed 45:19 tell 61:5 100:16 112:4 temperature 12:22 20:7 24:9 97:8, 11 temperatures 8:25 12:18, 20, 24 16:12, 15 18:2 20:20 23:17 24:6, 14 25:3 33:9 88:9 96:25 97:2, 14 110:23 Temple 22:13 58:9 ten 9:13 21:5 27:22 44:11 112:7 ten-year 105:23 term 59:10	terms 44:20 46:14 108:16 terribly 46:12 test 70:7, 12 93:24 94:17 tested 70:9 testified 28:24 43:17 testifiers 89:11 testifies 15:9 testify 5:15 15:8 51:8 64:10 68:21 90:2 92:9, 11, 15 114:25 testimonials 109:22 testimonies 108:22 testimony 2:17 5:12 6:20 7:5 14:25 15:5, 17 25:13, 16 26:2 29:7, 9, 16 35:13 46:11 49:5 50:22 51:15, 21 57:6, 9, 17 63:17, 24 66:25 69:6 70:3 74:3, 8, 9, 22 77:7, 11 81:12, 14 82:3 92:22 98:25 99:8, 17 100:5 104:4, 8 105:7, 9 110:15 114:8 115:5 testing 22:17 70:20 97:22 tests 70:17 101:5 thank 4:18 14:15 15:4 25:15 29:8, 15 42:16, 17 45:16, 22, 24 48:11, 12 50:20 51:3, 5, 11 57:7, 8, 14 58:7, 11 63:12, 15, 16 67:24 68:7, 8, 15 77:4, 9, 10, 11 81:13, 14 82:2 90:6, 7 91:25 92:23 98:23, 24 100:3 104:14 112:12,
--	--	--	---	---	---

13 114:7, 9 115:9, 14, 16, 23 thanking 99:23 thanks 32:8 89:25 thick 74:14 thing 34:3, 8, 24 38:16 52:13 55:19 61:4 64:24, 25 67:10 71:6 103:23 things 16:2 21:4 30:7 33:23 36:10 39:9, 16 50:13 64:7 65:9 66:3, 21 72:5 73:17 79:16 80:22 81:9 90:8 91:18 109:10 110:6 111:13 think 15:6 21:23 35:15, 21 43:10 48:14, 20 49:23 50:8 63:4 64:21, 23 66:18 67:14, 18 68:4 77:7 78:17 80:16, 20 81:5, 10 82:18 87:19 88:15 90:8, 9, 11, 15 91:15, 19 109:5 113:13 thinking 30:4 90:12, 22 113:9 thinks 64:24 third 19:10 75:2 THOMAS 1:10 2:2 3:14, 20, 25 4:7, 15, 16 5:11 6:17, 22 15:4, 14 25:15, 23 26:4 29:8 32:24 33:15, 18 35:6 39:24 40:4, 9, 18 41:6, 16 42:16 43:21 45:16 46:6 48:12 49:19 51:6, 11 57:8,	14, 19, 24 58:11 63:16 67:24 68:14 69:3, 10 77:10 81:13 90:6 92:7, 12, 20, 24 98:24 99:6, 10, 14, 24 100:12, 13 103:18, 24 112:12, 20 113:23 114:6 115:8 thoughts 43:2 threatening 83:17 Threats 98:11 three 18:11 19:14 80:23 86:3 94:23 97:18 three-hour 18:15 threshold 86:9 Thursday 1:7 2:3 Tidwell 25:22 26:3, 6 tied 52:23 53:14 time 5:25 12:2 18:10, 16 19:16, 17, 24 20:11 21:10 22:16 30:8, 17 32:16 39:10 68:9 91:14 98:23 101:9 110:13 111:13 113:5 timeframe 18:15 58:23 times 18:9 19:4, 14, 15 25:2 36:20 53:7, 12, 25 71:11, 14, 16 79:3 80:7 94:23 115:3 title 100:14 titles 4:25 Today 2:3 4:25 5:13 7:5 27:6 28:25 45:23 46:11 49:5 50:5, 22 51:21 68:16 100:18 103:15 108:23 110:16 111:10, 14	113:15, 19 114:4, 8 115:2, 6, 11 today's 2:6 told 100:11 ton 21:25 22:3 102:5, 11, 22 106:23 107:5 tons 9:21 105:24 106:4, 13, 22 Tookany 58:19 87:4 Tookany/Tacon y-Frankford 55:13 69:19 tools 96:16 top 31:16 45:13 106:17 topic 14:5 Topics 10:17 Toran 58:3, 4, 5, 8 64:18 total 28:13 55:2 touch 30:19 105:8 109:10 touched 110:25 tough 64:22 townships 73:24 toxic 53:25 81:6 93:21 94:22 95:14 toxicities 79:23 toxicity 52:5 55:11 trace 62:12 traction 87:11, 17 traditional 27:2 traffic 18:23 42:6, 7 trailers 11:8 trails 8:2 training 66:8, 22 67:21, 23 97:18 98:3 trainings 74:20, 25 75:12 transcript 117:8, 22 transition 108:9 Transportation 6:25 14:24	26:16, 22 96:18 travel 7:15 26:15 travels 61:9 treat 7:8 9:4 11:2 12:3 13:12 42:24 44:7 treated 110:22 treating 9:14, 25 treatment 13:11 15:23 96:12 98:16 treatments 18:7 56:10 trenches 39:7 trend 59:10 trickle 66:23 tries 42:10 troubled 7:24 truck 10:6 16:22 18:9, 10 19:6, 9, 13 20:12 24:11 42:7 75:18 trucks 11:9 12:3 16:19 20:24 24:8 97:7 true 54:2 117:7 truly 81:6, 8 truthful 78:14 80:14 try 9:12, 14 39:9 43:19 63:13 trying 41:25 86:12 103:23 turn 100:25 103:8 turns 18:25 two 11:7, 9, 21 18:11, 14 19:14, 19 22:3 24:10 42:19 54:16 92:10, 14 97:6 102:21 type 43:2, 3 types 10:10 66:21 81:2 typical 61:21 Tzu 80:4 < U >	U.S 26:12 27:22, 25 28:7, 17 59:17 ultimately 85:22 uncovered 14:12 understand 2:7 20:15 46:2 50:4, 9 72:21 76:23 100:18, 19 105:12 110:10 understanding 41:13 49:4 97:10 understood 22:19 Unfortunately 26:19 unhealthy 84:13 unique 8:9 90:15 uniquely 86:25 unit 10:23 United 32:22 33:8 107:2 units 16:20 University 22:13 58:9 untreated 101:8, 11, 16 updates 13:19 upgrade 38:7 upset 80:10 upstream 45:6 89:16 upward 59:11 62:24 urban 58:10, 16 61:22 79:4 82:21 84:4 87:2 usage 10:17 12:15 13:2, 4 21:21 44:22 use 6:2 7:6, 19 9:22 11:5 12:11 13:6 14:14 16:7 17:21 21:12, 20 22:8 23:6 24:7, 13, 18, 20 31:15 42:23 43:3, 12, 15 47:18 48:17 49:24 50:17, 25 52:23	53:14 56:6, 22 60:18 67:3 70:20 82:9 87:14, 15 88:14 93:7 97:11 105:6 106:22 111:7 112:4 users 7:16 9:18 uses 20:20 22:6 23:3 105:23 USGS 86:6 usually 78:25 79:4, 9, 12, 14 utility 39:6 utilizing 47:4 < V > Valley 71:3 variability 59:8 variable 67:4, 13 various 73:24 vary 55:4 vegetables 13:16 vegetation 9:11 65:14 vehicle 26:20 27:18 28:5, 9 vehicles 11:3 17:19 26:11 27:9 28:22 29:6 76:17 vehicle's 27:15 versus 43:12 49:25 vested 82:6 veterinarian 77:23 78:2 Veterinary 77:24 Vice 3:10 view 2:16 viewers 5:18 Virginia 52:22 visual 103:22 104:17 106:5 vital 98:17 volunteer 69:16, 20, 23 volunteers 93:24 94:15 95:2 96:15 97:23
---	--	---	---	--	---

vomit 80:6	81:22 82:2	went 75:23	22 84:9 94:15,	written 66:25
vomiting 80:7	83:3 85:4, 25	90:11	24 96:15	74:3, 8, 22
vulnerable	86:5, 7, 19, 22	we're 15:6, 7	98:18	77:7
83:15	89:3, 7 90:20	16:13, 16 19:8,	winters 24:19	
	92:25 93:12,	11 21:14 22:3,	78:6	< Y >
< W >	17 95:5, 6, 16,	5 25:2 29:3	wiping 79:16	yard 14:11
walk 81:2	20 96:3, 8, 11,	30:12 34:12	Wisconsin	yards 84:20
walked 79:3, 4	19 97:4 98:12,	35:13, 23, 24	54:17 74:17	Yeah 107:11
walkways	16, 20	37:19, 24	75:13	year 24:2
97:20	water/wastewat	38:21 39:18	wish 73:18	32:8, 12 36:17
Walton 69:24	er 11:2	40:5, 10 41:21	wishes 115:5	37:3, 12, 13, 18,
93:2, 3 94:8	waters 50:12	43:18 45:12	Wissahickon	20, 21, 23, 24
96:14	70:7 93:9	47:17 49:12	45:11 55:12	39:22 40:23
want 2:5	watershed	50:10, 16, 18,	58:18 60:5	46:14 47:14,
29:12, 15, 16	54:19 59:14	25 53:10, 22,	83:2 84:5	25 49:3 54:6
30:19, 20	69:17, 19 70:4	24 54:7 55:21	87:3	59:6 61:6
31:22 33:23	71:18	56:20, 21 57:4	witness 6:15	62:2 70:11
34:4 41:23	watersheds	59:2 64:9, 10	15:11, 12	71:10 78:9
45:22, 23	55:14 96:6	68:5 83:9	25:21 51:9	84:13 94:25
47:11 50:20	waterway 55:3	89:21 90:15,	57:11, 12 58:2	years 9:13, 19
58:10 64:19	waterways	22 91:5 93:5	68:22 77:17,	13:3 21:5
68:15 73:16	52:19 82:22	99:21 106:12	19 81:17, 18	22:12 26:16,
99:23 100:3	83:4 88:20, 22	114:15, 20	92:18 99:3, 4	21 27:23 28:6
101:7 107:23	89:24 93:25	western 23:11	witnesses 5:13,	36:18, 20, 21
113:15 114:7	96:17	wetting 101:23	24 6:12 68:20	37:7, 12 38:14
115:9	way 9:4	we've 27:6	92:11, 15	41:24 44:11
wanted 40:10	11:13 24:7	34:3 42:21	112:18 113:18	51:24 53:3, 22
104:9	31:11 32:5	53:2 62:9	114:25 115:10,	55:24 58:21,
warblers 72:15	34:16 36:19	73:15 82:18	18	25 59:9, 16
warm 33:5	38:17 43:24	113:5, 13	witnessing	70:9 78:3, 5
34:19 98:12	52:22 61:9	whatnot 44:18	35:25	80:15 82:20
warmer 18:2	63:14 64:8	widespread	wondering	93:14 94:10
97:5	66:3 75:16	62:20 63:3	46:15	95:7 100:7
washed 18:5	89:14	65:8 76:10	woods 93:9	112:7
washes 13:17	ways 65:9	wildlife 72:2	word 10:22	yellow 107:14
71:24 82:15	87:12	77:2 83:6	work 12:19	yielded 94:19
84:19 96:6	wear 79:17	84:15, 18	18:17, 22	York 56:14
waste 19:21	weather 8:15	93:10 98:16,	19:16, 24	67:11
wasted 76:22	26:13 27:24	19	22:13 45:25	
Watch 69:25	33:5 34:20	William 59:15	55:10 62:16	< Z >
70:5 93:22	36:7, 8 67:4	61:14	64:13 81:24	zero 109:18
94:4 96:15	79:20 96:22	Williams	89:15, 18 90:7	
97:22	97:4	39:20 41:24	91:16 109:5	
watched 58:21	webs 84:4	willingness	114:19 115:15,	
75:17	weekly 69:20	114:11	22	
Water 7:21,	weight 81:8	Winter 1:17	worked 11:20	
23, 24 11:10	Wein 81:19,	5:7 7:7, 9, 20	working 50:23	
13:11 14:4	20, 21	8:6 10:2, 14,	59:3 63:11	
16:8 18:21	welcome 2:6	16 11:13, 16,	69:21 85:2	
19:2 20:4, 8	well 6:9 12:8	20 12:7 15:24	89:21	
30:3 31:5, 13,	36:14 40:20	16:5 20:13	works 21:11	
14 34:20 35:3	41:12 49:13	24:18, 21	98:6 103:6	
44:7, 8, 9, 15,	53:16 63:23	26:13 27:24	workshops	
23 45:12, 14	66:11 72:7	28:2, 8 34:15,	10:16 109:4	
51:19 52:9, 16	78:14 79:7	18 54:3, 8	world 62:22	
53:17, 23	82:18 91:3, 21	60:9 61:7, 17,	111:21, 22	
54:12 56:3	106:20 113:25	18 69:25	worse 35:19	
59:19 61:11	115:19	70:10, 16	worst 32:14	
72:4, 17, 20, 23		71:12 82:15,	worth 25:4	