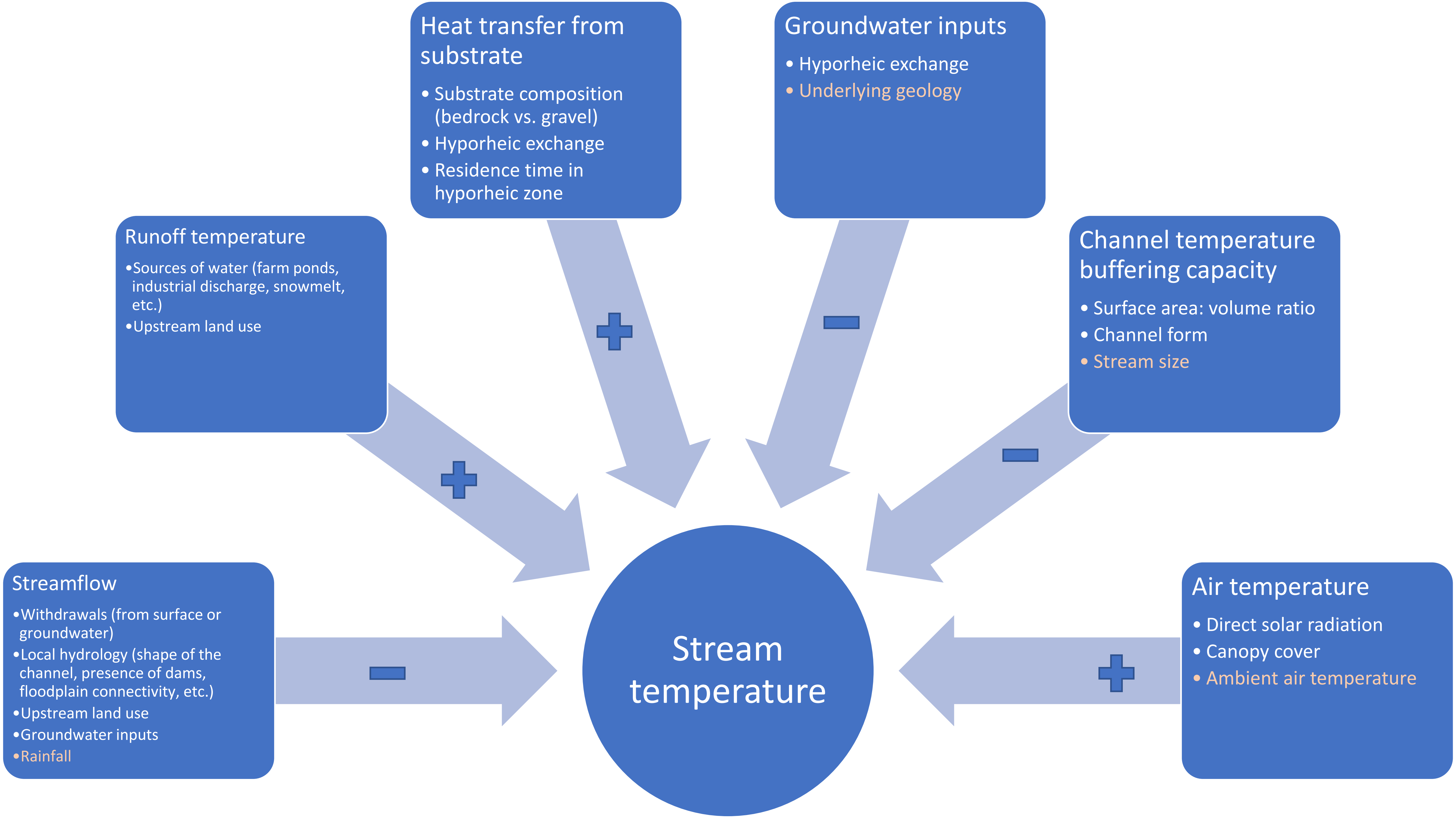
Update on CBT STAC Workshop Proposal

Rising Watershed and Bay Water Temperatures—Ecological Implications and Management Responses:

* What freshwater and estuarine species and habitats are threatened by climate-induced water temperature changes?
* What changes to the Bay tidal water quality WQS regulations are needed?
* What BMP characteristics can help mitigate increasing water temperature?
* How should priorities for BMP implementation be changed based on increasing water temperature considerations?
* How should habitat restoration programs and fisheries management be modified in light of current and projected temperature increases?
* Are modifications needed in Bay monitoring networks and modeling tools to track these changes

Multi-workgroup approach led by R. Hamner and a interdisciplinary steering committee


Heat transfer from substrate
• Substrate composition (bedrock vs. gravel)
• Hyporheic exchange
• Residence time in hyporheic zone
Groundwater inputs
• Hyporheic exchange
• Underlying geology
Runoff temperature
• Sources of water (farm ponds, industrial discharge, snowmelt, etc.)
• Upstream land use
Channel temperature buffering capacity
• Surface area: volume ratio
• Channel form
• Stream size
Streamflow
• Withdrawals (from surface or groundwater)
• Local hydrology (shape of the channel, presence of dams, floodplain connectivity, etc.)
• Upstream land use
• Groundwater inputs
• Rainfall
Stream temperature
Air temperature
• Direct solar radiation
• Canopy cover
• Ambient air temperature

A + B + C + D + E

∑ [Δ Land Use] + [Upland BMP Δ} + [Stream Corridor Δ} + [Corridor BMP Δ]

A = *Land Use Temp Effect*: ambient stream temps influenced by heat island effect: Forest << Pasture/Crops << Suburban <<< Urban

B = *Upland BMP Effect:* reflects how the ponding, infiltration or filtration of runoff modifies baseflow temps (may + , - or have no change from the land use baseline)

C = *Stream Corridor Effect*: reflects the *current* presence or absence of riparian/floodplain cover along the corridor (i.e., + or -)

D = *Corridor BMP Effect*: Whether the installation of a new BMP in the corridor influences stream temps, relative to the historical corridor baseline. (i.e., + or -)

E = *Riverine/Reservoir Effect*: the increase in stream temp as it moves from headwaters thru rivers (and is warmed by reservoirs and impoundments, until it ultimately reaches head of tide

Classification for BMP Temp Effect

1. Known Heaters
2. Suspected Heaters
3. Eventual Shaders
4. Shade Removers
5. Known Coolers
6. Suspected Coolers
7. Thermally Neutral
8. Uncertain or Unknown

Known Heaters

- Upland BMPs that increase downstream temperatures due to surface ponding via detention or retention of runoff, to a depth of up to 10 feet.
- Examples include wet ponds, created wetlands, dry ED ponds, farm ponds and CAFO lagoons
- Increase from 2 to 10 degrees F from the land use baseline.
- No engineering techniques exist to mitigate heating, except for deep-water release from much deeper reservoirs and impoundments.

Suspected Heaters

- Have some, but not all, of the characteristics of known heaters

- Not well studied from a temperature standpoint.

- Examples include sand filters, submerged gravel wetlands, underground vaults and MTDs w/closed bottoms and longer runoff detention times.

- May also include urban and ag drainage systems, such as grass channels, bio-swales, ditches and crop tile drains.

3. Eventual Shaders

- Upland or corridor forestry practices that increase forest canopy/forest cover after a decade or two.
- Upland BMPs: tree planting, tree pits, foundation planters -- greatest cooling effect occurs over impervious cover.
- Corridor BMPs: riparian forest buffers and some forms of floodplain restoration

4. Shade Removers:

- Land development activities, farming and stream corridor practices that remove riparian forests from the stream corridor, relative to the historic baseline year for actual cover.
- Examples may include: farm buffers that have expired, some forms of stream channel restoration, and construction site clearing during new land development

5. Known Coolers

- Urban BMPs designed to move surface runoff back into shallow groundwater, where it may reside for several days before reaching the headwater stream network.

- Good examples include infiltration and bioretention practices <u>that lack underdrains.</u>

- Limited research suggests the cooling effect can range from 2 to 5 degrees F, depending on site soils and hydro-geology

6. Suspected Coolers:

- Urban BMPs such as infiltration, permeable pavement, dry swales and bioretention that are located in tight soils, and therefore require underdrains.

- Not sure about green roofs and floating treatment wetlands?

- Could well be some research data out there on these suspected coolers

7. Thermally Neutral:

Urban and Ag BMPs that do not change stream temps, one way or the other.

Urban: street sweeping, urban nutrient management plans, IDDE

Ag: farm nutrient management, various tillage practices

Not a lot of monitoring data, however

USWG Ask to Help Out

- Any comments on delta-T equation and BMP Temp classification
- Any temp research on urban BMPs
- Help fill out urban Portion of BMP temp co-benefits matrix being developed for the STAC workshop
- Represent USWG at the workshop?
- Provide input to me by 4/30