Welcome and Overview

Meeting Objectives
- Review full list of identified indicators
Discuss data collection and analysis findings
Provide direction on key questions
Confirm recommendations for prioritization and simplification
Provide updates on other related meetings and activities

Dashboard Indicators Status and Data Collection Findings

Data
- Database hosting and Dashboard platform
  - Phoebe: AGRC will host the data; can work with multiple platforms (Esri or Socrata or TBD)
  - Jon: will be served up as REST services
  - Phoebe: Platform may be hosted by SL County (slight preference towards ESRI); SL County MetroStat will still be a Socrata
  - Phoebe: As an end-user, you will be able to access the data from either platform; some pros/cons associated with each (e.g., Esri better at mapping, Socrata better at charting, etc.)
- Indicator display
  - Jim: Think about layman interpretation - for example, present all indicators so that high values are good
  - Shelby: Use color symbology or other technique to make things consistent, won't have the same scale across indicators
  - Jim: think about being color blind compliant in color schemes
- Data availability and details
  - Maura: what data are going to be made available: input/output, raw/QC'd, pre/post analysis
  - Judy: post-analysis definitely, need to continue exploring discussing pre-analysis availability
  - Phoebe: we can protect input sources and not make them available depending on security preferences
  - Jim: wants it to be clear where the data are coming from even though will be made centrally available, wants to see metadata from source
  - Phoebe: data have to have metadata or won't be used

Central Wasatch Commission
- Kimberly: SLC approved; Salt Lake County approved
  - Sandy City Council reviewing next Tuesday
  - Next up is Cottonwood Heights
  - Tentative meeting on May 9

Ecosystems
- Vegetation Data/Indicators
  - Kirk: Add meadows to other ecosystems? In 8-9000 ft have some montaine meadows
    - Lee: are we talking about tall forb communities
    - Mary: Also have short forb
    - Kirk: Prefer term meadow to indicate mountain, needs clarification
    - Renee: asking Kirk to pinpoint meadows on LandFire dataset to figure out what being mapped as now
    - Mary: Guessing alpine short forb
    - Jim: thinks overestimates deciduous forest component
    - Renee: also looked at REGAP? But went with LANDFIRE instead, didn’t want to mix the two sources
    - CNHP will take conversation offline for continue discussion
  - Joan: need to document stressors such as human and natural stressors (e.g., beetle kill, fire, etc.);
  - Joan: In the future higher resolution vegetation imager can be expected; right now LANDFIRE is the best that we have to work with
    - Maura: Can set the dashboard up to accommodate better vegetation data in the future
    - Phoebe: yes to some degree, my need to crosswalk vegetation classes but nothing precludes it
Maura: wonders if there is a way to summarize vegetation data for the public and then break down into specific ecosystems
  - Original vision for project included the notion that different intervals would occur; reality of what we have to deal with
  - Update on an annual basis - at any given point there will be more information and some things will remain static; no more than bi-annual recommended
Joan: the datasets are updated infrequently because the things change slowly unless there is a wildfire or some other event
  - RCAT (Riparian Condition Assessment Tool)
    - Joan: since LANDFIRE data isn't great for riparian areas, isn't it good that we have the RCAT data?
    - Lee: Yep, it's great and we're excited
Other ecosystem indicators
  - Jim: Suggest dropping fragmentation - concept that will be very difficult for people to understand; not sure if this will be helpful
  - Most interested in how the public is going to react and use the information
  - Keep things simple in a way that people will recognize; avoid too many classifications for vegetation
  - Marian: In Phase 1 Environmental Working Group, fragmentation and connectivity came up quite a bit so thinks we should include it but needs explanation to policymakers (maybe rebrand fragmentation as connectivity)

Plants & Wildlife
  - Marian: notice that wildlife data is mostly citizen science, do we need to caveat?
  - Lee: yes, with citizen science datasets, ability to interpret change over time is limited

Soils
  - If soils drop off, soils folks are very interested (e.g., Park City); keep that in mind and check with them

Water
  - Marian: macroinvertebrate data are available from state for the Wasatch back area; waiting to see it and assess it
  - Jim: Public will not be interested in absolute flow rates; how to make the data interpretable?
    - Amy: Described water thresholds as a way to make information more accessible

Other Discussion
  - For point to area, is there a buffer of applicability we can use
    - Is it good to show points because then gaps are clear?
    - Judy: June steering committee gets to the gaps and prioritizing them
  - Rolling up to watershed level is very important
    - Show people how it was rolled up
    - Marian: what watershed level - HUC12
    - Judy: does rolling up dilute the results or make them too generic?

Wrap up & Next Steps
  - The next Steering Committee meeting will be held on June 28, 2017 from 3:00 to 5:00 pm. The focus of the meeting will be indicator updates and data gaps.
# Today’s Agenda

<table>
<thead>
<tr>
<th>Time</th>
<th>Session Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>3:00 – 3:10</td>
<td>Welcome and Overview</td>
</tr>
<tr>
<td>3:10 – 4:40</td>
<td>Indicator Status and Data Collection Findings</td>
</tr>
<tr>
<td>4:40 – 5:00</td>
<td>Other News, Updates and Action Items</td>
</tr>
</tbody>
</table>
Today’s Objectives

• Review full list of identified indicators
• Discuss data collection and analysis findings
• Provide direction on key questions
• Confirm recommendations for prioritization and simplification
• Provide updates on other related meetings and activities
Committee Roles and Expectations

- Participate in bi-monthly meetings
- Keep abreast of any missed meetings by reviewing notes
- Help guide the project towards success
  - On scope
  - On schedule
  - On budget
- Help connect the project team to appropriate technical experts
- Serve as an ambassador of the project as you interact with various groups, organizations, and the public
- Help with decision-making and finding consensus when we reach decision points
- Raise any questions, comments, or concerns with the project management team
Dashboard Indicators

Status of Indicator Development and Data Collection Findings
<table>
<thead>
<tr>
<th>Major Project Tasks</th>
<th>Stakeholder Group Engagement</th>
<th>January</th>
<th>February</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization of information into elements, targets, nested targets, indicators, thresholds, and stressors</td>
<td><strong>Steering Committee</strong></td>
<td><strong>Begin Development of Dashboard Indicators, Thresholds &amp; Stressors</strong></td>
<td><strong>Continue Development of Dashboard Indicators, Thresholds &amp; Stressors</strong></td>
<td><strong>Continue Data Inventory &amp; Assessment</strong></td>
<td><strong>Complete Data Gap and Database Development</strong></td>
<td><strong>Continue Data Acquisition and Database Development</strong></td>
<td><strong>Continue Data Acquisition and Database Development</strong></td>
</tr>
<tr>
<td><strong>Creation of Data Information System</strong></td>
<td><strong>Central Wasatch Commission &amp; Public Updates</strong></td>
<td><strong>Begin Data Inventory &amp; Assessment</strong></td>
<td><strong>Begin Data Inventory &amp; Assessment</strong></td>
<td><strong>Begin Data Acquisition &amp; Database Development</strong></td>
<td><strong>Central Wasatch Commission and Public Update #1 (to be confirmed)</strong></td>
<td><strong>Evaluate and Prioritize Data Gaps for Completion and Continue Current Conditions Assessment</strong></td>
<td><strong>Steering Committee #8: Data Gap Analysis</strong></td>
</tr>
<tr>
<td>Development of a database that can be transformed into an online dashboard</td>
<td><strong>Central Wasatch Commission &amp; Public Updates</strong></td>
<td><strong>Develop Report Outline</strong></td>
<td><strong>Steering Committee #6: Dashboard Indicators &amp; Report Outline</strong></td>
<td><strong>Continue Data Inventory &amp; Assessment</strong></td>
<td><strong>Steering Committee #7: Dashboard Wireframe and Data Inventory</strong></td>
<td><strong>Central Wasatch Commission and Public Update #1 (to be confirmed)</strong></td>
<td><strong>Steering Committee #8: Data Gap Analysis</strong></td>
</tr>
<tr>
<td><strong>Current Conditions Assessment &amp; Gap Analysis</strong></td>
<td><strong>Central Wasatch Commission &amp; Public Updates</strong></td>
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</tr>
<tr>
<td>Evaluating current conditions against the Dashboard indicators, thresholds, and stressors and identification and prioritization of data gaps</td>
<td><strong>Central Wasatch Commission &amp; Public Updates</strong></td>
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</tr>
</tbody>
</table>
Dashboard Development

Steering Committee Role

• Let us know if something doesn’t make sense
• Help us identify opportunities to simplify and consolidate/streamline

Technical Expert Role

• Detailed review and vetting of each indicator and draft thresholds
• Provide connections to data
• Reality check of current conditions assessment
Dashboard Indicators: Big Picture

Current Status
- 42 on the “short list” for continued verifying
- Wide variations in spatial and temporal coverage
- Many broad ecosystems indicators
- Fewer topic-specific indicators
- Mix of ready-to-use public indicators and new indicators based on technically credible methodologies

Overall Vision
- Manageable number of indicators to assess and maintain
- Quality indicators to illustrate overall health
- Each indicator is sensitive to changes and tells a unique story (current conditions and future updates)
Dashboard Indicators

Indicator Summary

- Over 100+ indicator ideas explored
  - See handout for 42 on “short list”
  - Summary matrix of element relationships/connections
  - Summary of indicator quality

- Preliminary Recommendations
  - 23 to keep
  - 13 to continue exploring
  - 6 to drop
Draft Indicators: Discussion Preview

**Situation**
Most the data within the water element are publicly available and updated frequently (e.g., hourly) whereas the ecosystems indicators rely on data sources updated every 5 years.

**Questions**
- When data are available at high frequency intervals, what is a reasonable summary timeframe (e.g., monthly, quarterly, annually)?
- Is it okay if the dashboard is more patchwork with some parts being regularly updated and others being more static?
Draft Indicators: Discussion Preview

Situation
In addition to varying timescales, some of the data sources are automatically updated and some require manual steps to acquire and process.

Questions
- How often should the dashboard be updated once the methodologies and current conditions are established under this contract?
- Who will be maintaining the dashboard and what is a reasonable budget expectation so we’re not developing a dashboard that isn’t practical to maintain?
Draft Indicators: Discussion Preview

Situation

• Our starting project vision was to aggregate indicators to the watershed level and also ‘roll up’ indicators to the element level.
• To do this we first needed to run all indicators to ground in terms of methodology and spatial granularity of available data.
• For many indicators we’re finding mixed results for spatial coverage.
• Further, some indicators rely on point source data that would require additional new methodologies for translating to area coverage.

Questions

• How important is it to see/summarize results at the watershed level?
• How important is it to “roll up” indicators to the element level?
• Is there value in converting point-based observations to area-wide coverages?
Data Inventory & Assessment

• DIGIT reviewed each of the draft indicators
  • Data sources and options
  • Calculation methodology and replicability
  • Spatial and temporal coverage
  • Database suitability
Data Collection & Gaps

This Meeting
• What we have learned about the availability/quality of data for the indicators identified
• Recommendations about which indicators should go to the next stages
  • Current conditions assessment
  • Data acquisition and database development

Upcoming Meetings
• Review the list of data gaps and prioritize/make recommendations for future completion
  • Addressing spatial/temporal gaps
  • Addressing topic/element gaps
  • Other wish list items for the future
Data Team Updates

• Database Hosting
  • AGRC will provide

• Data Platform
  • Recent web meeting to explore ESRI capabilities
  • Some preference for ESRI platform

• Quarterly Meetings
  • Next one on May 25
  • Exploring platform needs and preliminary costs
## Ecosystem Indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Quality Assessment</th>
<th>Recommendation</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetation Condition Class (forests, shrublands)</td>
<td>★★★</td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td>Landscape Disturbance Index (all ecosystems)</td>
<td>★★★</td>
<td>✔️</td>
<td>Needs revision; ski areas look worse than urban areas</td>
</tr>
<tr>
<td>Riparian Vegetation Departure - Riparian</td>
<td>★★★</td>
<td>✔️</td>
<td>Aligns with terrestrial departure from existing conditions</td>
</tr>
<tr>
<td>Invasive Species</td>
<td>★★★</td>
<td>!</td>
<td>May be good as a target/general indicator; not well documented throughout project area; could tie with soil stability</td>
</tr>
<tr>
<td>Beaver Restoration Assessment Tool - Riparian</td>
<td>★★★</td>
<td>!</td>
<td>Could be used as a proxy for beaver ecosystems; may be best to inform strategy development</td>
</tr>
<tr>
<td>Degree of Fragmentation (all ecosystems)</td>
<td>★★★</td>
<td>!</td>
<td>Need to select from among various options</td>
</tr>
<tr>
<td>Common Bird Species (all ecosystems)</td>
<td>★★★</td>
<td>!</td>
<td>Limited data availability (citizen-science based; lack of consistent effort across years makes results difficult to interpret)</td>
</tr>
<tr>
<td>Rare Plant Species (cliffs, maybe others)</td>
<td>★★★</td>
<td>!</td>
<td>Limited data availability</td>
</tr>
<tr>
<td>Level of Protection (all ecosystems)</td>
<td>★★★</td>
<td>✗</td>
<td>Can be controversial; recommend not using due to challenges associated with process of defining &quot;protection.&quot;</td>
</tr>
</tbody>
</table>

### Quality Assessment Levels
- ★★★: Good to go
- ★★: Usable but some flaws/issues
- ★: Major gaps/Issues

### Recommendations
- ✔️: Keep
- !: Continue Exploring
- ✗: Drop
Ecosystems Indicators

**Terrestrial Ecosystems**
- Forests
  - Aspen
  - Spruce-Fir
  - Mixed Conifer
- Shrublands
  - Oak
  - Mixed Mountain Shrub / Maple
  - Sagebrush
- Other
  - Alpine
  - Cliffs

**Riparian and Aquatic Ecosystems**
- Riparian
- Wetlands
- Lakes

**Indicators that Apply To Multiple Ecosystems**
- Vegetation condition class
- Landscape disturbance index
- Degree of fragmentation
- Invasive species
- Common bird species
- Rare plant species
Ecosystems Indicators

Vegetation Condition Class (applies to all forest & shrub systems: Aspen, Spruce-fir, Mixed Conifer, Oak, Maple/Mixed Mountain Shrub, Sagebrush)

- Data Source: LANDFIRE (U.S. Forest Service)
- Evaluation of ecosystem health based on how different species composition, structural stage, and canopy closure of existing vegetation is compared to reference conditions (i.e., estimated historical conditions).
- Proposed scoring categories reported as % departure from reference condition. These categories would be a reclassification of the original LANDFIRE categories, to reduce number of scoring categories from 6 down to 4, and to match R-CAT reporting categories for riparian.

<table>
<thead>
<tr>
<th>Departure Percentage</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-16%</td>
<td>Excellent</td>
</tr>
<tr>
<td>17-33%</td>
<td>Good</td>
</tr>
<tr>
<td>34-66%</td>
<td>Fair</td>
</tr>
<tr>
<td>67-100%</td>
<td>Poor</td>
</tr>
</tbody>
</table>
Ecosystems Indicators

Vegetation Condition Class - Example results maps

NOTE: Proposed roll-up scheme for watershed level reporting would be the same for LANDFIRE & R-CAT metrics
Ecosystems Indicators

Landscape Disturbance (applies to all ecosystems)

- Data Source: Landscape Disturbance Index (developed jointly by CNHP & DIGIT for this project)
- Measure of ecosystem condition based percent of each ecosystem that is affected by permanent or long-term anthropogenic land use related disturbance (i.e., cumulative impacts from mappable infrastructure)
- Land uses included:
  - Roads (primary/secondary, local/primitive)
  - Urban development (high/medium density, low density)
  - Powerlines
  - Agricultural fields (tilled, untilled)
  - Recreation infrastructure (ski lifts, cross-country ski trails, trails & trailheads, campgrounds, picnic areas)
Ecosystems Indicators

Landscape Disturbance – draft LDI map

- Darker = less disturbed; lighter = more disturbed

- Initial draft shows ski areas as greater disturbance than urban areas

- Need to adjust weights and/or inputs to correct double-counting of some input layers
Ecosystems Indicators

Landscape Disturbance – Potential Scoring Categories (reported as percentage of total that is disturbed)

<table>
<thead>
<tr>
<th>One Option: evenly distributed</th>
<th>Another Option: unevenly distributed</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 24% Excellent</td>
<td>0-10% disturbed Excellent</td>
</tr>
<tr>
<td>25-49% Good</td>
<td>11-20% Good</td>
</tr>
<tr>
<td>50-75% Fair</td>
<td>21-30% Fair</td>
</tr>
<tr>
<td>≥ 75% Poor</td>
<td>&gt;31% Poor</td>
</tr>
</tbody>
</table>

• From an ecological perspective it makes more sense to go with the unevenly distributed option
Ecosystems Indicators

Riparian Vegetation Departure (Riparian ecosystem)

- Data Source: R-CAT (Riparian Condition Assessment Tool, Wheaton et al Lab, UT State Univ.)
- Condition of existing riparian vegetation compared to presumed (modeled) pre-European settlement vegetation (i.e., reference condition).
- Proposed scoring categories reported as % departure from reference condition. These categories would be a reclassification of the original R-CAT categories to match LANDFIRE reporting categories for terrestrial ecosystems.

<table>
<thead>
<tr>
<th>Departure Range</th>
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<tbody>
<tr>
<td>0-16%</td>
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<tr>
<td>17-33%</td>
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<tr>
<td>34-66%</td>
<td>Fair</td>
</tr>
<tr>
<td>67-100%</td>
<td>Poor</td>
</tr>
</tbody>
</table>
Ecosystems Indicators

Riparian Vegetation Departure – Raw Results Map
(dk. green = excellent, lt. green = good, yellow = fair, red = poor)

NOTE: final color ramp will NOT be green-red continuum
Ecosystems Indicators

Riparian Vegetation Departure – Proposed Roll-up Scheme for Watershed Level Scoring

• If any single category is >50%, that category is the watershed score.
• If highest percentage category is Negligible or Minor but combined totals of Large & Significant are > or =, score is Significant.
• If highest percentage category is < combined totals of worse categories, score is increased by one level.
• If highest percentage category is < combined totals of better categories, score is decreased by one level.
### Ecosystems Indicators

#### Riparian Vegetation Departure – Sample from results table showing watershed level scoring

<table>
<thead>
<tr>
<th>HUC12 Name</th>
<th>Departure Class</th>
<th>% of riparian in this HUC</th>
<th>Watershed score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain Tunnel Creek</td>
<td>Large</td>
<td>13%</td>
<td></td>
</tr>
<tr>
<td>Drain Tunnel Creek</td>
<td>Significant</td>
<td>31%</td>
<td>X</td>
</tr>
<tr>
<td>Drain Tunnel Creek</td>
<td>Minor</td>
<td>20%</td>
<td></td>
</tr>
<tr>
<td>Drain Tunnel Creek</td>
<td>Negligible</td>
<td>36%</td>
<td></td>
</tr>
<tr>
<td>Dry Creek-Jordan River</td>
<td>Large</td>
<td>15%</td>
<td></td>
</tr>
<tr>
<td>Dry Creek-Jordan River</td>
<td>Significant</td>
<td>16%</td>
<td></td>
</tr>
<tr>
<td>Dry Creek-Jordan River</td>
<td>Minor</td>
<td>37%</td>
<td>X</td>
</tr>
<tr>
<td>Dry Creek-Jordan River</td>
<td>Negligible</td>
<td>32%</td>
<td></td>
</tr>
<tr>
<td>Headwaters Big Cottonwood Creek</td>
<td>Large</td>
<td>21%</td>
<td></td>
</tr>
<tr>
<td>Headwaters Big Cottonwood Creek</td>
<td>Significant</td>
<td>29%</td>
<td>X</td>
</tr>
<tr>
<td>Headwaters Big Cottonwood Creek</td>
<td>Minor</td>
<td>33%</td>
<td></td>
</tr>
<tr>
<td>Headwaters Big Cottonwood Creek</td>
<td>Negligible</td>
<td>18%</td>
<td></td>
</tr>
</tbody>
</table>
Potential Ecosystems Indicators

Invasive Species

- Data Source: EDDMapS West (Early Detection & Distribution Mapping System)
- Citizen-science based dataset, not consistent across study area, may be more appropriate at the watershed scale than ecosystem scale.
- Known problems with dataset (e.g., there are only a few occurrences of smooth brome which is much more widespread than this dataset suggests)
- Options:
  - Use selectively (select species)
  - Eliminate this indicator
Potential Ecosystems Indicators

Beaver Restoration Potential

- Data Source: BRAT (Beaver Restoration Assessment Tool, Wheaton et al. Lab, UT State Univ.)

- Possible indicator for riparian ecosystem condition (includes presence of suitable vegetation, base flow water availability, flooding power).

- Could be used as a proxy for beaver ecosystems; may not be consistent across study area; may be more appropriate for informing strategy development.
Potential Ecosystems Indicators

Connectivity/Fragmentation

• Options:
  • Assess general connectivity at study-area scale by mapping core areas (using the LDI) and potential corridors (species, processes); base scoring on sum of corridor distances (i.e., longer distances = worse connectivity)
  • Assess general fragmentation using perimeter:area ratio of core areas (as defined above), summed for each watershed (this is fastest/easiest method).
  • Assess ecosystem fragmentation by calculating a weighted sum of linear miles of road within each patch (weight major roads higher than local roads) and roll up into a score per system per watershed.
Ecosystem Indicators

Others Ideas Explored

- Common bird species
- Plant species
- Macroinvertebrates (see Water)

Next Steps

- Continue evaluation of ebird dataset for appropriate species; otherwise move to data gaps with recommendation to establish Breeding Bird Survey route(s) and Christmas Bird Count circle(s) in study area
- Evaluate results of herbaria search & georeferenced map
- Identify data source(s) for macroinvertebrates; otherwise move to data gaps
Plants & Wildlife Indicators

Plants

- Plant experts on Technical Advisory Committee recommend *plants as ecosystem indicators, not species targets*

Deer and Elk

- UT Division of Wildlife Resources data are not in deliverable format now, and not likely to be compiled during timeline for Phase 1; *include in data gaps for now* with intention to add to Dashboard when data become available

Boreal Toad

- UDWR recommends *remove species from target list*; only one/very few known locations, not representative at study area scale; would not want data in publicly-accessible database

Raptors (Boreal Owl, Northern Pygmy Owl, Northern Goshawk, Golden Eagle)

- Per UDWR and USFS, only available data are localized and not representative of study area; UDWR & Hawkwatch collaborating on raptor database, but results not expected during timeline for Phase 1; *include in data gaps for now* with intention to add to Dashboard when data become available; note UDWR & Hawkwatch do not have records for Boreal Owl – drop this species

Bonneville Cutthroat Trout

- Still waiting response from UDWR re data availability for this species
# Air Indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Quality Assessment</th>
<th>Recommendation</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground-Level Ozone</td>
<td>★</td>
<td>✔</td>
<td>Higher elevation data lacking</td>
</tr>
<tr>
<td>Particulate Matter 2.5</td>
<td>★</td>
<td>✔</td>
<td>Higher elevation data lacking</td>
</tr>
<tr>
<td>Particulate Matter 10</td>
<td>★</td>
<td>✔</td>
<td>Higher elevation data lacking</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>★</td>
<td>✗</td>
<td>Does not seem to be major concern</td>
</tr>
<tr>
<td>Lead</td>
<td>★</td>
<td>✗</td>
<td>Does not seem to be major concern</td>
</tr>
<tr>
<td>Nitrogen Dioxide</td>
<td>★</td>
<td>✗</td>
<td>Does not seem to be major concern</td>
</tr>
<tr>
<td>Sulfur Dioxide</td>
<td>★</td>
<td>✗</td>
<td>Does not seem to be major concern</td>
</tr>
</tbody>
</table>

**Quality Assessment Levels**
- ★ Good to go
- ★★ Usable but some flaws/issues
- ★★★ Major gaps/issues

**Recommendations**
- ✔ Keep
- ✗ Continue Exploring
- ✖ Drop
Air Indicators

Ground Level Ozone
- Expressed as # of days over ozone standard
- Facilitated by hot, still days
- Affects sensitive vegetation and ecosystems
- Can cause damage during growing season

Data & Assessment Details
- Spatial coverage is lacking
  - Monitoring points in Salt Lake City, Snowbird, Summit County
- Temporal information is patchy
  - Data available daily in Salt Lake City
  - Monitoring conducted seasonally in Summit County
- MetroStat is already tracking ozone
Air Indicators

Particulate Matter 2.5 and 10
• Expressed as # of days over particulate matter standard
• Main cause of reduced visibility (haze)
• Can settle on ground and water, changing nutrient balances and affecting ecosystem diversity

Data & Assessment Details
• Spatial coverage is lacking
  • Monitoring points in Salt Lake City and Summit County
• Temporal information is patchy
  • Data available daily in Salt Lake City
  • Monitoring conducted seasonally in Summit County
• MetroStat is already tracking particulate matter
Air Indicators

Others Ideas Explored

• Visibility
• Temperature

Next Steps

• Discuss recommendations with Technical Experts
• Retrieval of Summit County air quality data
• Selection of data sources and database connection
• Current conditions calculations for selected indicators
## Soils Indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Quality Assessment</th>
<th>Recommendation</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil Erosion Hazard</td>
<td>✪</td>
<td></td>
<td>Data are very rarely updated. Could be used for current conditions.</td>
</tr>
</tbody>
</table>

### Quality Assessment Levels
- ✪ Good to go
- ✫ Usable but some flaws/issues
- ✧ Major gaps/issues

### Recommendations
- ✔ Keep
- ! Continue Exploring
- ✗ Drop
Soil Indicators

Erosion Hazard

- Scale ranges from slight to very severe
- Methodology takes into account soil erodibility factor and slope gradient
- Based after disturbance activities but does not take into account vegetative cover

Data & Assessment Details

- Custom layer that has detailed methodology available
- Good spatial coverage of study area
- Underlying soil data updated very infrequently/irregularly
### Soil Indicators

#### Names and Percentages

<table>
<thead>
<tr>
<th>Name</th>
<th>Not rated</th>
<th>Slight</th>
<th>Moderate</th>
<th>Severe</th>
<th>Very severe</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silver Creek</td>
<td>4.7</td>
<td>48.7</td>
<td>34.3</td>
<td>9.5</td>
<td>2.7</td>
<td>100.0</td>
</tr>
<tr>
<td>Kimball Creek</td>
<td>1.0</td>
<td>24.8</td>
<td>35.6</td>
<td>21.9</td>
<td>16.8</td>
<td>100.0</td>
</tr>
<tr>
<td>Toll Canyon-East Canyon Creek</td>
<td>0.0</td>
<td>34.3</td>
<td>28.2</td>
<td>21.8</td>
<td>15.7</td>
<td>100.0</td>
</tr>
<tr>
<td>Drain Tunnel Creek</td>
<td>0.0</td>
<td>10.5</td>
<td>33.5</td>
<td>33.3</td>
<td>22.5</td>
<td>100.0</td>
</tr>
<tr>
<td>Cottonwood Canyon-Provo River</td>
<td>0.0</td>
<td>4.9</td>
<td>24.1</td>
<td>36.1</td>
<td>34.8</td>
<td>100.0</td>
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<tr>
<td>Snake Creek</td>
<td>0.0</td>
<td>23.3</td>
<td>45.2</td>
<td>19.0</td>
<td>12.5</td>
<td>100.0</td>
</tr>
<tr>
<td>Dry Creek-Jordan River</td>
<td>1.5</td>
<td>63.9</td>
<td>11.7</td>
<td>7.6</td>
<td>15.3</td>
<td>100.0</td>
</tr>
<tr>
<td>Headwaters Big Cottonwood Canyon</td>
<td>0.3</td>
<td>4.8</td>
<td>19.1</td>
<td>21.6</td>
<td>54.2</td>
<td>100.0</td>
</tr>
<tr>
<td>Headwaters Little Cottonwood Canyon</td>
<td>0.1</td>
<td>5.4</td>
<td>18.6</td>
<td>16.3</td>
<td>59.5</td>
<td>100.0</td>
</tr>
<tr>
<td>Outlet Little Cottonwood Creek</td>
<td>3.7</td>
<td>49.7</td>
<td>9.1</td>
<td>7.9</td>
<td>29.6</td>
<td>100.0</td>
</tr>
<tr>
<td>Outlet Big Cottonwood Creek</td>
<td>2.1</td>
<td>55.5</td>
<td>9.7</td>
<td>6.1</td>
<td>26.6</td>
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</tr>
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<td>Barneys Creek-Jordan River</td>
<td>0.5</td>
<td>96.3</td>
<td>2.5</td>
<td>0.5</td>
<td>0.1</td>
<td>100.0</td>
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<td>Headwaters Mill Creek</td>
<td>0.0</td>
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<td>13.5</td>
<td>19.3</td>
<td>65.1</td>
<td>100.0</td>
</tr>
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<td>Parleys Creek</td>
<td>0.8</td>
<td>5.4</td>
<td>19.1</td>
<td>25.2</td>
<td>49.6</td>
<td>100.0</td>
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<tr>
<td>Outlet Mill Creek</td>
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<td>85.4</td>
<td>4.7</td>
<td>1.9</td>
<td>5.3</td>
<td>100.0</td>
</tr>
<tr>
<td>Red Butte Creek-Emigration Creek</td>
<td>59.6</td>
<td>27.7</td>
<td>9.1</td>
<td>2.0</td>
<td>1.6</td>
<td>100.0</td>
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<tr>
<td>Parleys Creek-Jordan River</td>
<td>75.4</td>
<td>14.1</td>
<td>4.8</td>
<td>2.9</td>
<td>2.8</td>
<td>100.0</td>
</tr>
<tr>
<td>Crystal Creek</td>
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<td>93.1</td>
<td>2.0</td>
<td>0.1</td>
<td>0.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Outlet Jordan River</td>
<td>54.0</td>
<td>44.6</td>
<td>1.0</td>
<td>0.2</td>
<td>0.2</td>
<td>100.0</td>
</tr>
</tbody>
</table>

#### Environmental Dashboard

- **Not rated**: 8.2%
- **Slight**: 30.3%
- **Moderate**: 17.0%
- **Severe**: 14.4%
- **Very severe**: 30.1%
- **Total**: 100.0%
Soil Indicators

Others Ideas Explored
• Soil Types
• Site Contamination

Next Steps
• Discuss recommendation with Technical Experts
• Compare against ecosystems indicators to make final decision about keeping or dropping
# Water Indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Quality Assessment</th>
<th>Recommendation</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observed Streamflow Volumes</td>
<td>★★</td>
<td>✔</td>
<td>Easily accessible, high quality data</td>
</tr>
<tr>
<td>Snow Water Equivalent</td>
<td>★★</td>
<td></td>
<td>Recommend moving from point data to areal estimates to capture orographic effects</td>
</tr>
<tr>
<td>Precipitation</td>
<td>★★</td>
<td></td>
<td>Recommend moving from point data to areal estimates to capture orographic effects</td>
</tr>
<tr>
<td>Tunnel Flow Volumes</td>
<td>★★</td>
<td></td>
<td>Readily available data represent volumes used for water supply, not overflow volumes to stream network.</td>
</tr>
<tr>
<td>Groundwater Levels</td>
<td>★★</td>
<td>✔</td>
<td>Needed indicator, some coverage gaps (both spatial and temporal)</td>
</tr>
<tr>
<td>Attainment of Designated Uses</td>
<td>★★</td>
<td>✔</td>
<td>Easily obtained data for attainment vs. nonattainment.</td>
</tr>
<tr>
<td>Attainment of Groundwater Classification</td>
<td>★★</td>
<td></td>
<td>Want to keep or modify this indicator but needs further exploration of technical merit.</td>
</tr>
<tr>
<td>Attainment of Tunnel Water Permit Limits</td>
<td>★★</td>
<td>X</td>
<td>Significant data issues, lack of data on the Wasatch front-side</td>
</tr>
<tr>
<td>Stream Health Index</td>
<td>★★</td>
<td></td>
<td>Want to keep this indicator but awaiting data for review</td>
</tr>
</tbody>
</table>
Water Indicators: Water Supply

Streamflow Volumes
• Water year-to-date streamflow volumes (% historical average)

Data & Assessment Details
• 4 selected stations on the Wasatch Front approximate native streamflows generated within the project area. Though they do include spring contributions and tunnel overflows, those contributions are relatively small compared to the snowmelt runoff.
• 3 selected stations on the Wasatch Back represent more heavily commingled flows from snowmelt runoff, springs, and tunnel discharges.
**Water Indicators: Water Supply**

**Snow Water Equivalent**
- Current month percent of historical median

**Data & Assessment Details**
- SNOTEL stations are best source of observed data but few stations within project area.
- Recommend method for assessing spatial snow over the project area to capture orographic effects (elevation, aspect, etc.).
Water Indicators: Water Supply

Precipitation

• Water year-to-date precipitation (% historical average)

Data & Assessment Details

• NOAA long-term data available for 24+ active precipitation stations in the project area.

• Recommend method for assessing spatial precipitation over the project area to capture orographic effects (elevation, aspect, etc.).
Water Indicators: Water Supply

Tunnel Flow Volumes

• Water year-to-date flow volumes (% historical average)
• Approximately 1/3 of drinking water in Park City and all drinking water in Alta/Snowbird comes from tunnel water.

Data & Assessment Details

• Publicly available data represent volumes used for water supply.
• Separate overflow data not readily available.
Water Indicators: Water Supply

Groundwater Levels

- Deviation from historical average below ground surface
- About ¼ of the water supply in Salt Lake County and 60% of Park City’s water supply comes from groundwater

Data & Assessment Details

- No known groundwater monitoring wells in the mountainous areas on Wasatch Front
- Park City monitors water levels in 3 drinking water wells
- 16 wells in USGS Active Monitoring Network have periodic measurements and long-term percentiles.
- No real-time or daily measurement wells in project area.
Water Indicators: Water Quality

Attainment of Designated Uses

• Categories assigned per Clean Water Act 305(b) requirements
• Categories indicate attainment/non-attainment of designated uses in surface waters

Data & Assessment Details

• Can use UT DEQ results directly
• Allow users to drill down into water quality data
Water Indicators: Water Quality

Attainment of Groundwater Classification

• Attainment/non-attainment of groundwater classification

Data & Assessment Details

• In progress - needs more discussion with technical experts though want to keep or modify this indicator.

• All groundwater in Salt Lake Valley on Wasatch front is classified as pristine or drinking water source.
Water Indicators: Stream Health

Stream Health Index

• Developed by UT DEQ. Based on observed to expected ratio of macroinvertebrates
• The quantity and diversity of macroinvertebrates are an integrated measure of stream health beyond what conventional grab samples can reflect

Data & Assessment Details

• In progress - needs more discussion with technical experts
• Salt Lake County has data for Wasatch Front
• UT DWQ has statewide data that may include a few samples in project area for Summit County
Draft Indicators: Discussion Topics

Situation
Most the data within the water element are publicly available and updated frequently (e.g., hourly) whereas the ecosystems indicators rely on data sources updated every 5 years.

Questions
• When data are available at high frequency intervals, what is a reasonable summary timeframe (e.g., monthly, quarterly, annually)?
• Is it okay if the dashboard is more patchwork with some parts being regularly updated and others being more static?
Draft Indicators: Discussion Topics

Situation
In addition to varying timescales, some of the data sources are automatically updated and some require manual steps to acquire and process.

Questions
• How often should the dashboard be updated once the methodologies and current conditions are established under this contract?
• Who will be maintaining the dashboard and what is a reasonable budget expectation so we’re not developing a dashboard that isn’t practical to maintain?
Draft Indicators: Discussion Topics

Situation

• Our starting project vision was to aggregate indicators to the watershed level and also ‘roll up’ indicators to the element level.
• To do this we first needed to run all indicators to ground in terms of methodology and spatial granularity of available data.
• For many indicators we’re finding mixed results for spatial coverage.
• Further, some indicators rely on point source data that would require additional new methodologies for translating to area coverage.

Questions

• How important is it to see/summarize results at the watershed level?
• How important is it to “roll up” indicators to the element level?
• Is there value in converting point-based observations to area-wide coverages?
Other Updates

Who else are we talking to? What else is going on with Mountain Accord?
Mountain Accord Phase 2 Update

• Central Wasatch Commission
  • Salt Lake County voted to support creation of CWC
  • 7 member board with representative from the state DOT and 6 local governments
Looking Ahead

Steering Committee Meetings

• #8: June
  • Data Gaps

• #9: August
  • Draft Current Conditions

• #10: October
  • Draft Report and Database

• #11: December
  • Final Report

Other Activities

• Continued development with Technical Experts

• Central Wasatch Commission coordination

• Data platform team coordination

• Data acquisition and current conditions analysis
Thank You!

Steering Committee
Meeting #7
April 26, 2017
<table>
<thead>
<tr>
<th>Draft Indicator</th>
<th>Healthy Air</th>
<th>Soil Stability</th>
<th>Water Supply</th>
<th>Water Quality</th>
<th>Terrestrial Ecosystems</th>
<th>Aquatic Ecosystems</th>
<th>Quality Assessment</th>
<th>Recommendation</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landscape Disturbance Index - Alpine</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>Needs some feedback; ski areas look worse than urban areas</td>
</tr>
<tr>
<td>Landscape Disturbance Index - Aspen</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>Needs some feedback; ski areas look worse than urban areas</td>
</tr>
<tr>
<td>Landscape Disturbance Index - Spruce-fir</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>Needs some feedback; ski areas look worse than urban areas</td>
</tr>
<tr>
<td>Landscape Disturbance Index - Mixed conifer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>Needs some feedback; ski areas look worse than urban areas</td>
</tr>
<tr>
<td>Landscape Disturbance Index - Oak</td>
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<td>✓</td>
<td>✓</td>
<td>Needs some feedback; ski areas look worse than urban areas</td>
</tr>
<tr>
<td>Landscape Disturbance Index - Maple/Mixed mountain shrub</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>Needs some feedback; ski areas look worse than urban areas</td>
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<tr>
<td>Landscape Disturbance Index - Sagebrush</td>
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<td>Needs some feedback; ski areas look worse than urban areas</td>
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<td>Needs some feedback; ski areas look worse than urban areas</td>
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<tr>
<td>Landscape Disturbance Index - Riparian</td>
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<td>Needs some feedback; ski areas look worse than urban areas</td>
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<td>Landscape Disturbance Index - Wetlands</td>
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<td>✓</td>
<td>Needs some feedback; ski areas look worse than urban areas</td>
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<tr>
<td>Degree of Fragmentation (for all ecosystems)</td>
<td></td>
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<td></td>
<td></td>
<td>✓</td>
<td>✗</td>
<td>Need to select from among various options</td>
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<tr>
<td>Level of Protection (for all ecosystems)</td>
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<td></td>
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<td>✗</td>
<td>✓</td>
<td>Can be messy; would be completed by ecosystem by watershed. Recommend not using due to challenges associated with process of defining “protection.”</td>
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<tr>
<td>Vegetation Condition Class - Aspen</td>
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<td></td>
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<td>Have discussed and recommend using</td>
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<td>Vegetation Condition Class - Spruce-fir</td>
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<td>Have discussed and recommend using</td>
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<td>Vegetation Condition Class - Mixed conifer</td>
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<td>✓</td>
<td>✓</td>
<td>Have discussed and recommend using</td>
</tr>
<tr>
<td>Vegetation Condition Class - Oak</td>
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<td>✓</td>
<td>✓</td>
<td>Have discussed and recommend using</td>
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<tr>
<td>Vegetation Condition Class - Maple/Mixed mountain shrub</td>
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<td>✓</td>
<td>Have discussed and recommend using</td>
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<td>Vegetation Condition Class - Sagebrush</td>
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<tr>
<td>Invasive Species</td>
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<td>✓</td>
<td>✗</td>
<td>May be good as a target/general indicator but not necessarily a good match for ecosystems; not well documented throughout project area; could tie with soil stability</td>
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<tr>
<td>Riparian Vegetation Departure - Riparian</td>
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<td></td>
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<td>✓</td>
<td>Aligns with terrestrial departure from existing conditions</td>
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<td>Beaver Restoration Assessment Tool - Riparian</td>
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<td></td>
<td>✓</td>
<td>✗</td>
<td>Taking a closer look; can be used as a proxy for beaver ecosystems; may not be consistent across study area; may be best to inform strategy development</td>
</tr>
<tr>
<td>Draft Indicator</td>
<td>Healthy Air</td>
<td>Soil Stability</td>
<td>Water Supply</td>
<td>Water Quality</td>
<td>Terrestrial Ecosystems</td>
<td>Aquatic Ecosystems</td>
<td>Quality Assessment</td>
<td>Recommendation</td>
<td>Notes</td>
</tr>
<tr>
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<td>------------------------</td>
<td>------------------</td>
<td>------------------</td>
<td>------------------</td>
<td>-------</td>
</tr>
<tr>
<td>Common Bird Species (for all ecosystems)</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>Limited data availability (citizen-science based; not a product of regularly scheduled surveys - lack of data or change across years difficult to interpret)</td>
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</tr>
<tr>
<td>Rare Plant Species (for cliffs, maybe others)</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>Limited data availability</td>
<td></td>
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<tr>
<td>Fish</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Need to keep investigating data availability</td>
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<tr>
<td>Ground-Level Ozone</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<td>Also monitored by SL County MetroStat; data for higher elevations is lacking</td>
<td></td>
</tr>
<tr>
<td>Particulate Matter 2.5</td>
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<td></td>
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<td>Also monitored by SL County MetroStat; data for higher elevations is lacking</td>
<td></td>
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<tr>
<td>Particulate Matter 10</td>
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<td>Also monitored by SL County MetroStat; data for higher elevations is lacking</td>
<td></td>
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<tr>
<td>Carbon Monoxide</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Data for higher elevations is lacking; this indicator does not seem to be an area of major air quality concern for the study area</td>
<td></td>
</tr>
<tr>
<td>Lead</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Data for higher elevations is lacking; this indicator does not seem to be an area of major air quality concern for the study area</td>
<td></td>
</tr>
<tr>
<td>Nitrogen Dioxide</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td>Data for higher elevations is lacking; this indicator does not seem to be an area of major air quality concern for the study area</td>
<td></td>
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<tr>
<td>Sulfur Dioxide</td>
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<td></td>
<td></td>
<td>Data for higher elevations is lacking; this indicator does not seem to be an area of major air quality concern for the study area</td>
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<tr>
<td>Soil Erosion</td>
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<td>Methodology is solid but frequency of updates may not be conducive to ongoing monitoring. Candidate for dropping if ecosystems targets adequately address vegetative cover.</td>
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<tr>
<td>Observed Streamflow Volumes</td>
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<td></td>
<td></td>
<td>Easily accessible data, high quality, very important to environmental health</td>
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<tr>
<td>Snow Water Equivalent</td>
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<td>Recommended moving from point data to areal estimates to capture orographic effects. Could be dropped as somewhat redundant to streamflow.</td>
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<tr>
<td>Precipitation</td>
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<td>Recommended moving from point data to areal estimates to capture orographic effects. Could be dropped as somewhat redundant to streamflow.</td>
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<tr>
<td>Tunnel Flow Volumes</td>
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<td>Readily available data represent volumes used for water supply, not overflow volumes into stream network, which are captured in the streamflow gages.</td>
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<tr>
<td>Ground Water Levels</td>
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<td>Needed indicator, some coverage gaps (both spatial and temporal).</td>
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<tr>
<td>Attainment of Designated Uses</td>
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<td>Classification is straightforward from CWA 305(b) requirements. Tricky thing from a presentation perspective is making water quality data available in the dashboard beyond the 305(b) classification.</td>
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<tr>
<td>Attainment of Groundwater Classification</td>
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<td>Want to keep or modify this indicator but needs further exploration of technical merit.</td>
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<tr>
<td>Attainment of Tunnel Water Permit Limits</td>
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<td></td>
<td>On Wasatch Front, have no publicly available data due to lack of permits. On Wasatch Back, have WQ data. Due to complexity of topic and disparity between sides, suggest narrative rather than quantitative representation.</td>
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<tr>
<td>Stream Health Index</td>
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<td>Want to keep this indicator but await data for review.</td>
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</tr>
</tbody>
</table>