Lake Tahoe

A natural resource

Known world-wide for skiing, hiking, water sports

Also home to 55,000 full time residents. 43,000 parcels

A key feature is the clear blue water of the lake.

The Tahoe community is vigilant about preserving their lake.
Stormwater Control with Best Management Practices (BMPs)

- Tahoe Regional Planning Agency (TRPA)

- Requires every property to have stormwater BMPs installed to prevent fine sediments from small storms (20 year, 1-inch) from leaving property.

- Puts significant burden on home owners. Expense for BMP design and installation is considerable.
What are BMPs?

Dripline Trench

Rain Garden

Baffled Trench

Retaining Wall

23 Different Types
Introducing the BMP Designer

Tool for Tahoe residents to design their own BMP plans and submit to TRPA for certification.

A web application – opens in any browser
A BMP Design

- Create BMPs for your rooftops, driveways, decks, steep sloped areas, and disturbed areas.

- Sketch drainage areas right on the map, using the aerial image as a guide.

- BMP Designer suggests the BMPs that could be used under the conditions, and you select the one you want.
A 5 Step Process

Modeled after Turbo-Tax

Step-by-step wizard breaks down complex regulatory and design process into easy steps.

Navigate backward and forward in the process using the same buttons on every screen.

Process diagram is always shown, and shows you where you are in the process.
Step 1: Specify Property

Option 1: Enter Your Street Address
Street Address: 2949 SPRINGWOOD DR
City: SOUTH LAKE TAHOE
Zip Code: 96150

Option 2: Enter APN (XXX-XXX-XX)
APN: 031-316-03

Option 3: Select Property on Map
Click the appropriate button below, then zoom to the property and click the parcel on the map.

APN: 031-316-03
Step 2: General Site Conditions

Tell BMP Designer about your property:

• Is it in high groundwater?
• Are there steep slopes?
• Where are the utility lines (you sketch them)?
• Are there any rock outcroppings (sketch)?
• Are there any existing retaining walls (sketch)?
• Are there large trees next to building and driveways (sketch)?
• Are there any easements (sketch)?

Information is used to find out where BMPs are needed, where to put them, and which BMPs are appropriate.
Step 2: Help from GIS

Map services run by TRPA are used to facilitate querying if property is in high groundwater zone, or if it has any steep slopes on it.

Both conditions significantly affect which BMPs can be used on the property, and where BMPs are required.
Step 2: Quality Control

• Each major stage has a Missing Information check at the end.

• Checks each screen in the stage to make sure you entered all required information, and that the values entered make sense.

• Complete QC is run at the end of the process once more to make sure the submittal is ready to be submitted.

• Reduces back-and-forth with TRPA significantly.
Step 3: Design your BMPs

General process is:

1. Sketch out drainage areas that are likely to generate significant runoff during storms.
   - Disturbed Areas (eg. unpaved dirt areas)
   - Rooftops
   - Driveways
   - Decks, Stairs, Walkways
   - Steep Slopes

2. Specify conditions for the drainage areas. Each drainage area type has different condition types. Eg. Rooftops – gutters, steep slopes at dripline.

3. BMP Designer recommends a list of BMPs that will work. Gives typical cost levels for construction and maintenance.

4. You pick which BMP you want.

5. BMP Designer sizes the BMP and locates it on the map to fit with your sketch of the drainage area.

6. You can then adjust the BMP shape and dimensions if necessary.
Step 3: Rooftop BMPs

4 rooftop sections on the property.

Note that a section is essentially a single drainage area that drains to an edge of the roof (may drain to a point in certain cases).
Step 3: Rooftop BMPs

First, draw drain lines (the edges where water leaves the roof).

Now, partition your roof into drainage areas.

Step 1. Draw pathway points or lines to which water flows and leaves the roof. Lines can be the edge of your roof, where either the water drains directly off to the ground, or is captured by a gutter. Points are unusual, but can occur when water is concentrated to a single point by two roofs coming together. The image below shows the drainage edges (orange lines) for a property. Note that you don’t need to draw downspouts at this point. In a later screen, you’ll be able to draw your gutters and downspouts.

Step 2. Draw the areas of the roof that drain to each final point. The image below shows the drainage areas in blue. Note each area drains to a drainage edge.

Draw Rooftop Drainage Edge  Draw Rooftop Drainage Point  Clear Rooftop Drainage Edges and Points
Step 3: Rooftop BMPs

Second, draw areas that drain to the edges.
Step 3: Rooftop BMPs

Finally, click the Define Drainage Areas button.

BMP Designer interprets your sketch, and converts it into drainage areas, where the area, width, length, storm volume generated, and direction of flow are known.
Step 3: Rooftop Conditions

BMP Designer then leads you through a set of screens for each rooftop.

Does the area have a gutter? Is the land under the dripline steep (> 5%)? How many stories? What type of surface is the land the water falls on?
Step 3: BMP Suggestion

The tool uses a decision tree to work through all the conditions specified and find the BMPs that will work in each rooftop.

Note that the decision tree is adjustable within the database that runs the tool.
Step 3: BMP Selection

When you select the BMP, the Designer then sizes it for the rooftop you selected, and draws it on the map.

You can adjust the size and shape in the next screen if you want.
Step 3: BMP Sizing

Sizing of the BMP is based on NRCS (National Resources Conservation Service) calculations, and additional automatic routines that are specific to each BMP type.

For a rooftop dripline trench, for example:

- Storm runoff volume = f(rooftop area)
- Treatment Capacity = f(Length, Depth, Width, Void Percentage)
- Requires that Treatment Capacity >= Storm Volume
- Length = Length of Roof + 1.5’ on either side

Iterative Algorithm to find depth and width:

- Width = 18” + (Number of Stories – 1) * 6”
- Depth = required depth to make treatment capacity = storm runoff volume
- If Depth > 10”, then
  - Increase width by 1”
  - Repeat until depth < 10”
  - If width reaches 36”, and depth > 10”, then make width 30”, depth 10”, and BMP is undersized
Step 3: Driveway BMPs

Sketch Driveway

Add a drainage point
And gradebreak

Add a drainage edge

Click Define
Drainage Areas
button

Two separate drainage areas are
defined, with flow determined

Area, storm runoff volume, length
of edges, etc. are determined.
Step 3: Driveway BMPs

• BMP Designer suggests a slotted channel drain to prevent flow from exiting property.

• Drain Rock Infiltration system is suggested to drain flow from slotted channel drain.

• Sized and placed by BMP Designer to remain on property and avoid utility lines, trees, etc.
Step 4: Submit your Design

BMP Designer auto-generates a submittal report for you, and submits to TRPA for review.

Communications with TRPA are handled through auto-generated e-mail notifications.
Step 5: Build your BMPs and Get Certified

• When your design is approved, you install the BMPs.

• Then, you request an inspection in Step 5.

• You can submit photos of the installed BMPs.

• TRPA might approve your install based on the photos, or come out for a field inspection.

• Once you’re approved, you get a BMP certificate, and TRPA marks your residence as certified in the database.
Underlying Technology

BMP Designer leverages a broad suite of technologies:

- **Microsoft**
  - Silverlight – a browser plug in (like Flash) that supports streamlined use of maps, tables, charting, user admin, etc. within a wide variety of browsers.
  - RIA – Rich Internet Applications – streamlines the process of creating a tool that integrates heavily with an underlying database.

- **ESRI**
  - Base Maps – the underlying map is served by ESRI, for free!
  - ArcGIS Server:
    - Used to create services to answer questions like:
      - Property location (geo-coding)
      - Is my property in high groundwater
      - Where are the steep slopes on my property
      - Soil Transmissivity of my property
      - Regional BMP check
    - Used to serve the underlying aerial imagery

- **Atkins**
  - Water Resources Artificial Intelligence (WRAI)™ for BMP sizing and placement
Applications Elsewhere...

Other BMP Processes
• Stormwater
  • Urban Areas
  • Other States
  • Flood Resilience
• Other BMP Types
  • Coastal Resilience
  • Agricultural
  • Construction

Expanded Applications
• Impacts to flood risk and water quality
  • By Parcel
  • Cumulative Impacts
• Incentives to Retrofit
  • Stormwater Tax Discount based on attenuated runoff from parcel
  • Public outreach and social media

Leveraging the Turbo-Tax approach in Other Regulatory Processes
• MS4
• FEMA
• Ice Road Planning
• Permafrost Foundation Design
More info, and Questions

Check out the Prezi: http://tinyurl.com/ks4npmm

Contact Steve Bourne for further Discussion
Stephen.Bourne@atkinsglobal.com