Pollutant Load Modeling Web Tool for Source Water Protection

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Motivations

- Concerns:
  - Contaminant risks to source water quality
  - Large multi-use watershed
  - Limited resources
  - Many landowners to engage on collaborative projects
- Solution:
  - Access to data-driven and cost-effective information to support planning efforts
  - Estimates for relative impacts of land use and BMPs on source water quality
  - Spatially aware to target various areas of the watershed

Overview

Project Setting

Model Components

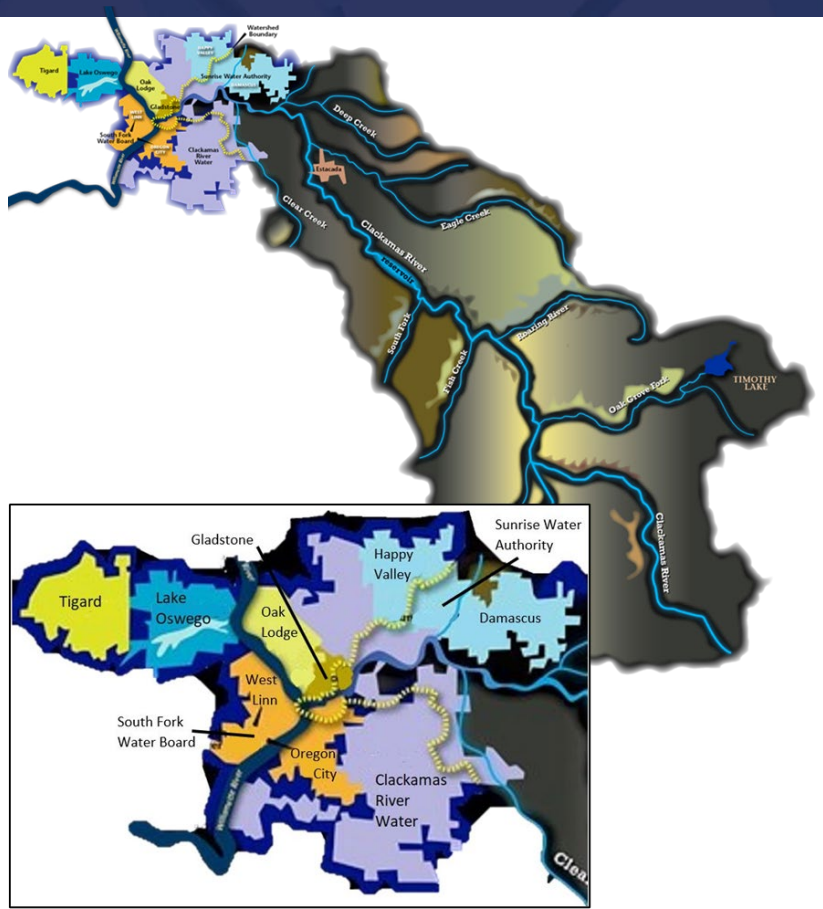
User Inputs and Interface

Live Demo

Takeaways

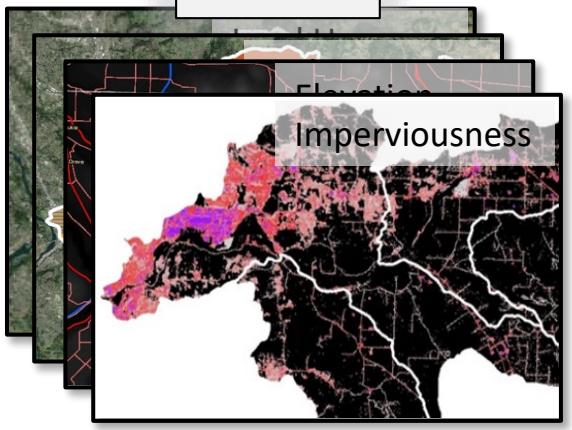
Project Setting

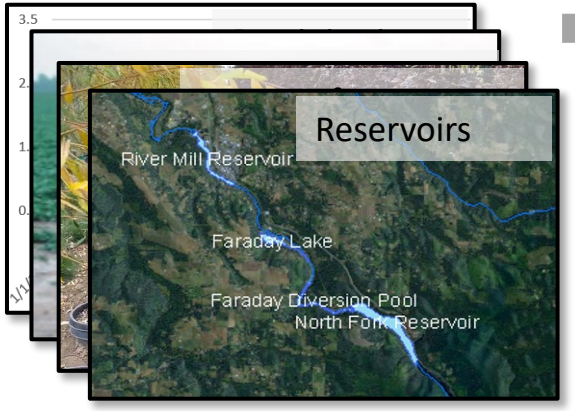
- Clackamas River Water Providers:
  - 8 municipal water providers on the Clackamas River
  - Serve over 300,000 people
- Watershed: over **940 square miles** (or over **600,000 acres**)
- Intakes: 4 of the 5 intakes are in the bottom **5 miles** of the **83 mile**-long river
- Drinking Water Protection Plan (DWPP) developed in 2010



Model Components

Data





User Input

1) Study Area

2) Pollutant of Concern

3) BMPs Used

4) BMP Extent

Calculations

1) Runoff coefficients

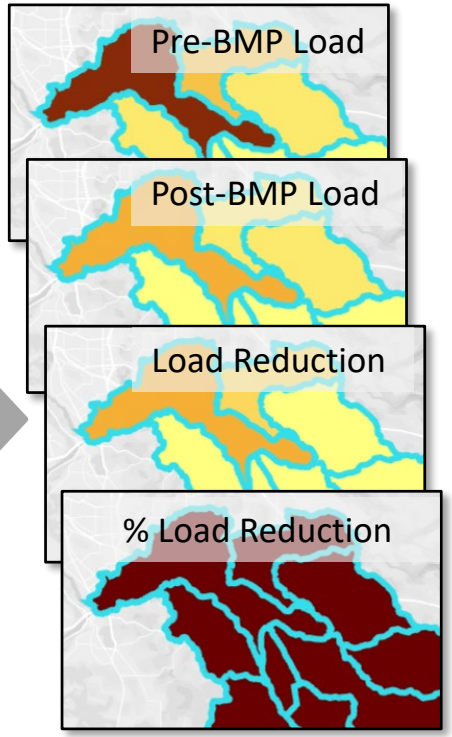
2) 30-yr normal annual runoff volume

3) Pollutant load from land surface

4) Effectiveness of BMPs

5) Load reduction by reservoirs due to settling

Output



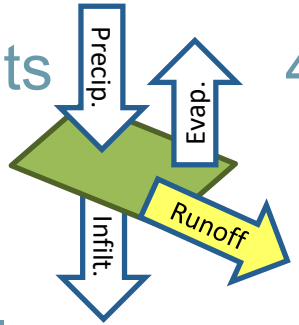
Model Components – Input Data

Data	Sources
• Land surface	• Land surface
– Land use	– Regional Land Information System (RLIS)
– Slope	– USGS National Elevation Dataset (NED)
– Soils	– NRCS Web Soil Survey
– Imperviousness	– USGS National Land Cover Database (NLCD)
• Pollutants	• Pollutants
– Event mean concentrations	– Various databases, literature, and best professional estimates
– Partition coefficients	
• Rainfall data	• Rainfall data
– Historical hourly record	– 4 local rain gages 2005/2007-2013
– 30-year precipitation normals	– PRISM Climate Group
• Best management practices	• Best management practices
– Hydraulics (% capture, % reduction)	– International BMP Database
– Effluent quality or % removal	– Best professional estimates
– Minimum treatable concentrations	
• Reservoirs	• Reservoirs
– Full pool surface area	– Existing CE-QUAL-W2 model
– Daily average discharge	– Powerhouse flows, fish flows, or USGS gages

Model Components – Calculations

1) Runoff coefficients

$$= \frac{Simulated\ Runoff}{Total\ Precipitation}$$



2) Annual runoff volume

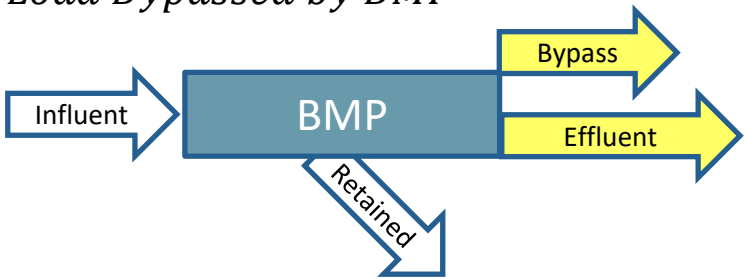
$$= Runoff\ Coefficient\ * 30\ yr\ Normal\ Precipitation\ * HRU\ Area$$

3) Load from land surface

$$= Runoff\ Volume\ * Pollutant\ Concentration$$

4) Load after BMPs

$$= Load\ from\ Areas\ without\ BMPs + Remaining\ Load\ in\ Treated\ Effluent + Load\ Bypassed\ by\ BMP$$

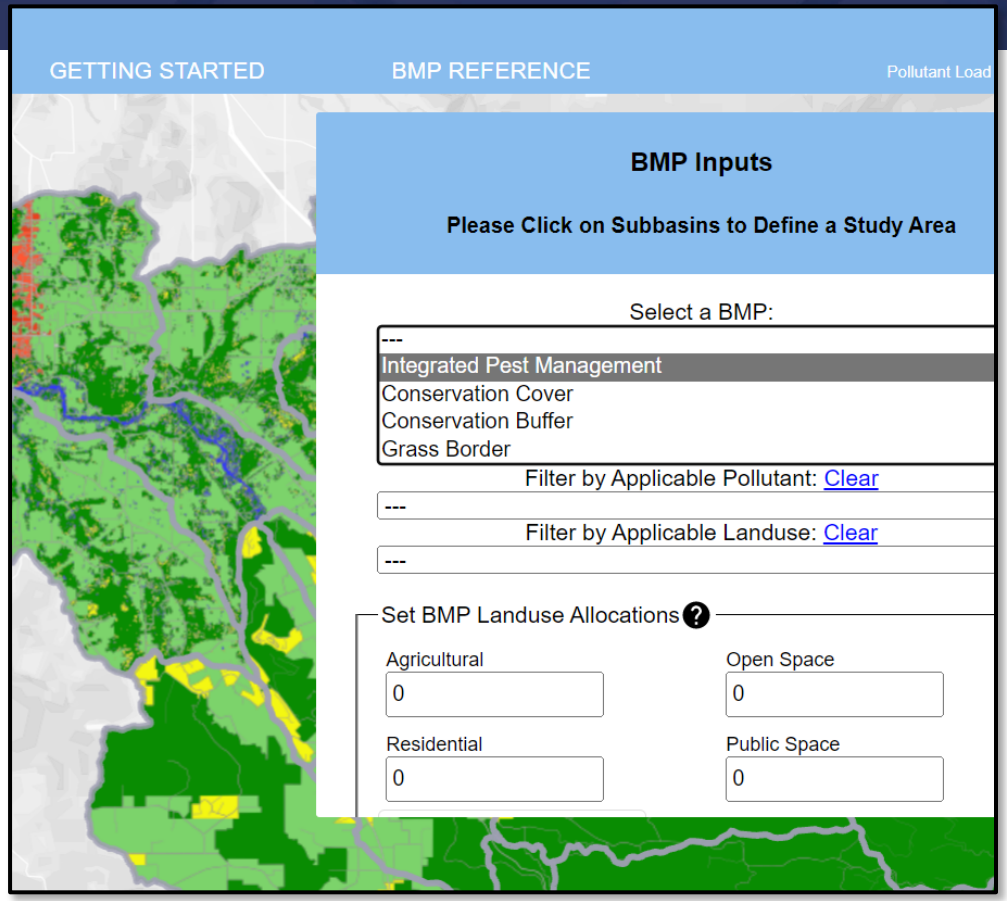


5) Attenuation by reservoirs

$$= \%\ of\ Particles\ Removed\ by\ Reservoir\ Due\ to\ Settling\ * \%\ Solids\ of\ Pollutant$$

User Inputs and Interface

- Key features:
  - Easy to learn and use
  - Interactive map
  - No special software needed
  - Publicly available
  - Save results
- Key user inputs:
  - Study area
  - Pollutant of concern
  - BMP types
  - BMP implementation extents



Example

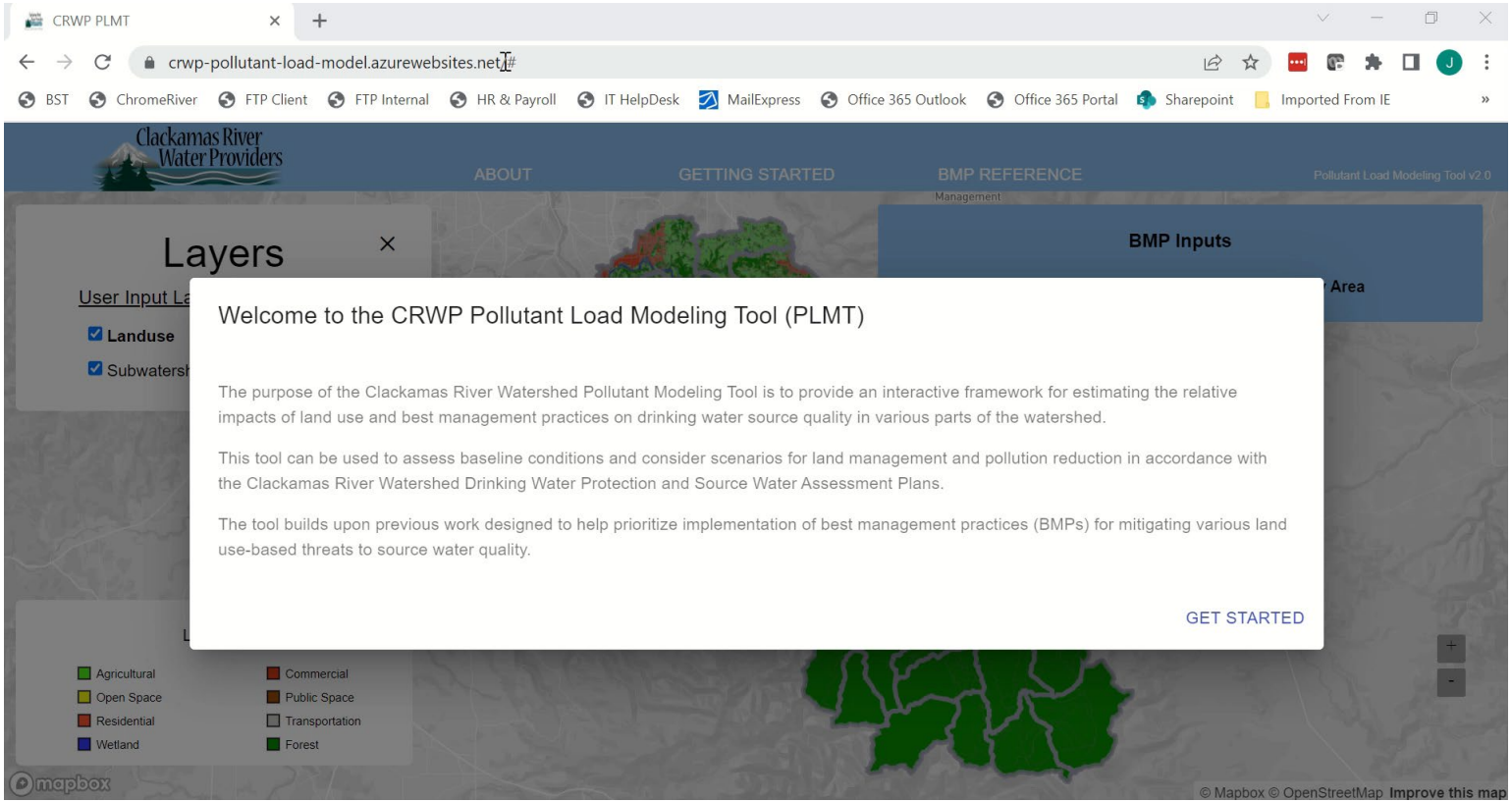
- Question: “As a manager, I want to know what management scenarios provide the largest benefit for pesticides in a basin close to the intake with predominantly agricultural land uses?”
- Define question in tool:
  - Study Area: Lower Clear Creek (Basin #606) is a tributary to the Clackamas River not far upstream of the first intake and has significant agricultural land
  - Pollutant of concern: glyphosate
  - BMP types: organic farming and cover crops
  - Implementation extent: 25% of agricultural land
- Desired response: Reductions in pesticide load achieved by various management scenarios

Live Demo

CRWP PLMT (crwp-pollutant-load-model.azurewebsites.net)

Geosyntec
consultants

Recorded Demo



Takeaways

- What's next?
  - Broaden user base and refine user experience
  - Implement cost estimation feature
- Other potential improvements:
  - Refine land uses (e.g. include specific crop types)
  - Allow user to model multiple BMPs in the same area
  - Your thoughts?

Contact Info

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Geosyntec consultants

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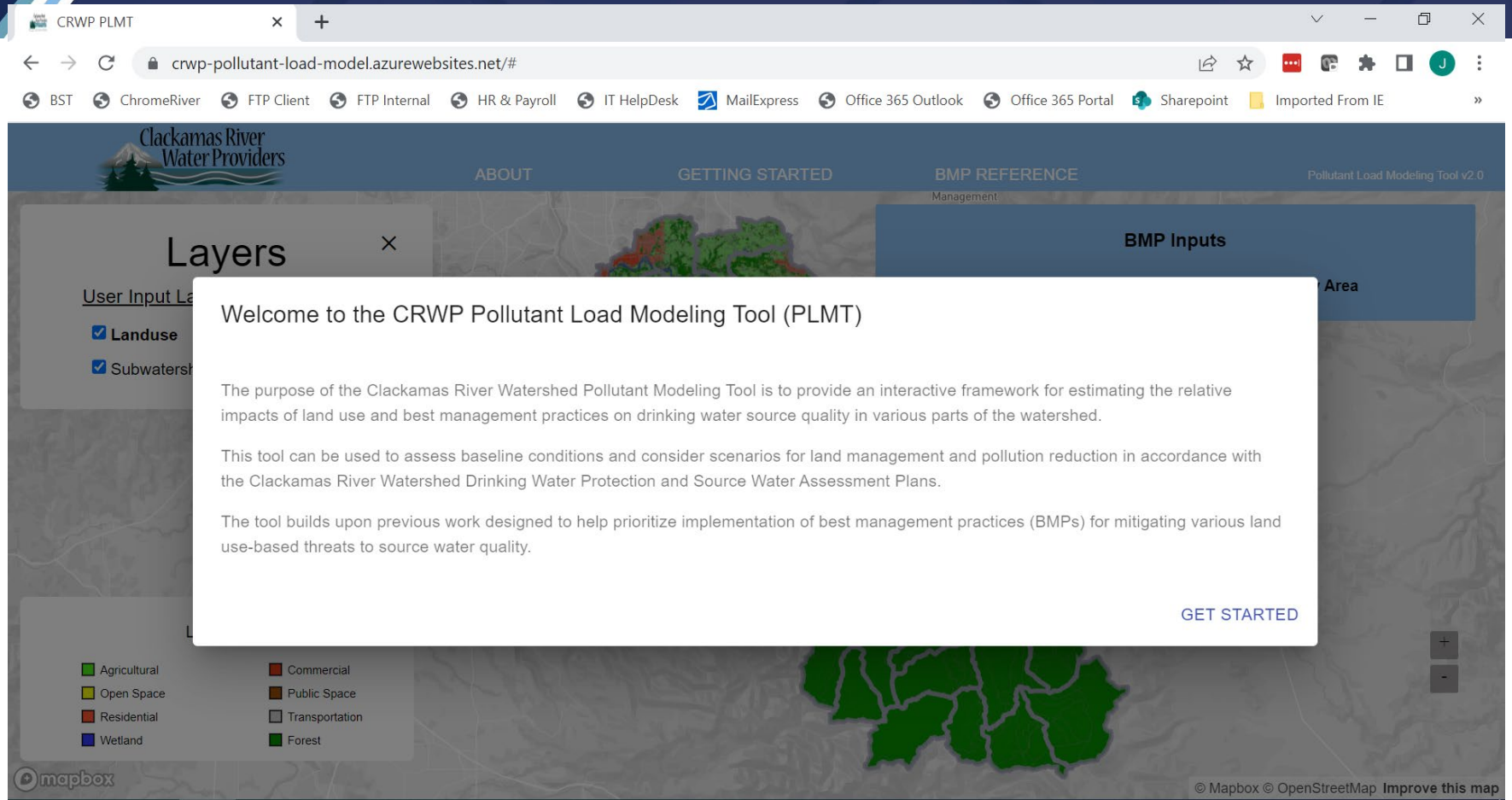
Clackamas River Water Providers

Working together to protect and conserve our drinking water.

Example Screenshots



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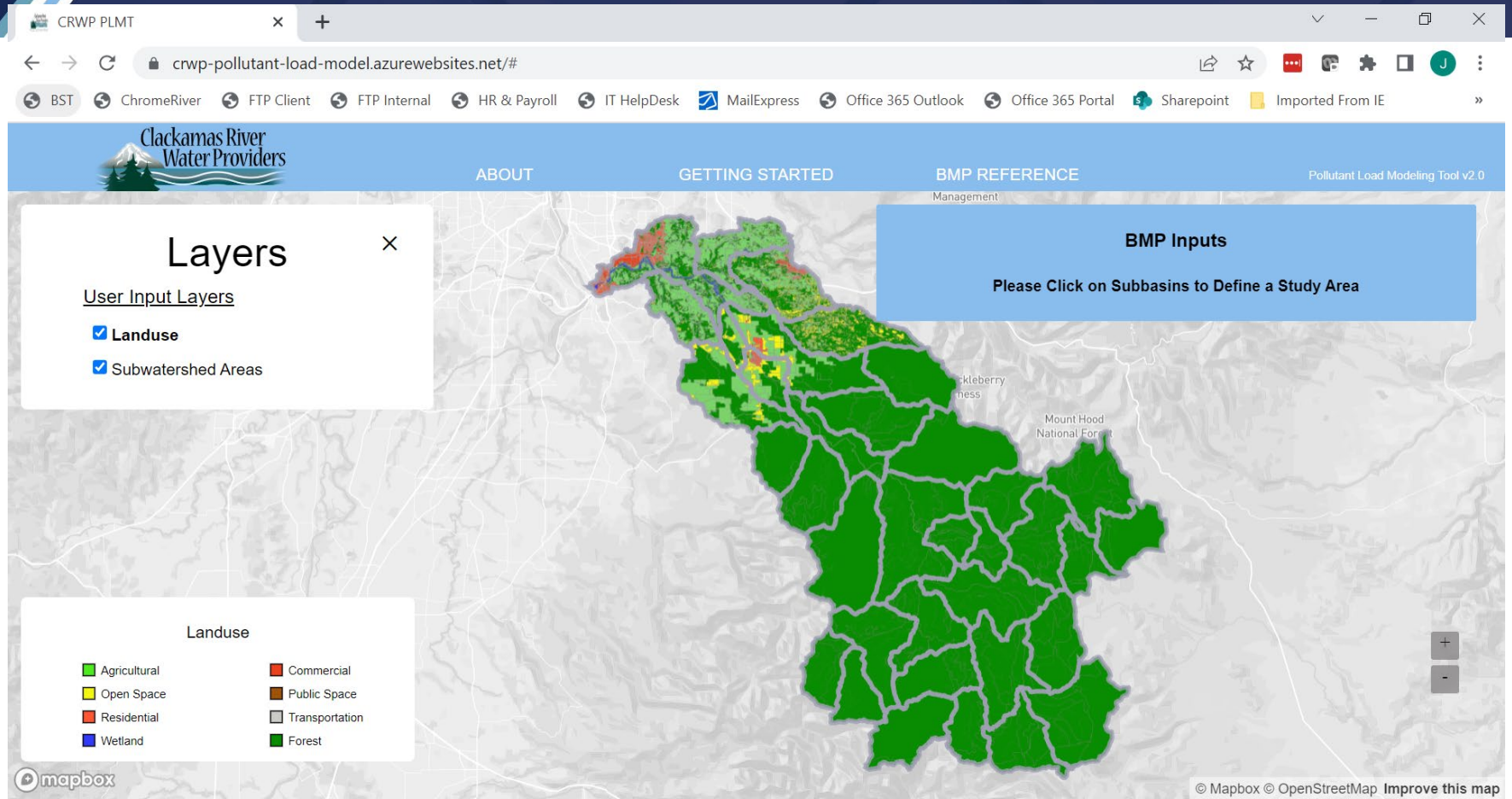

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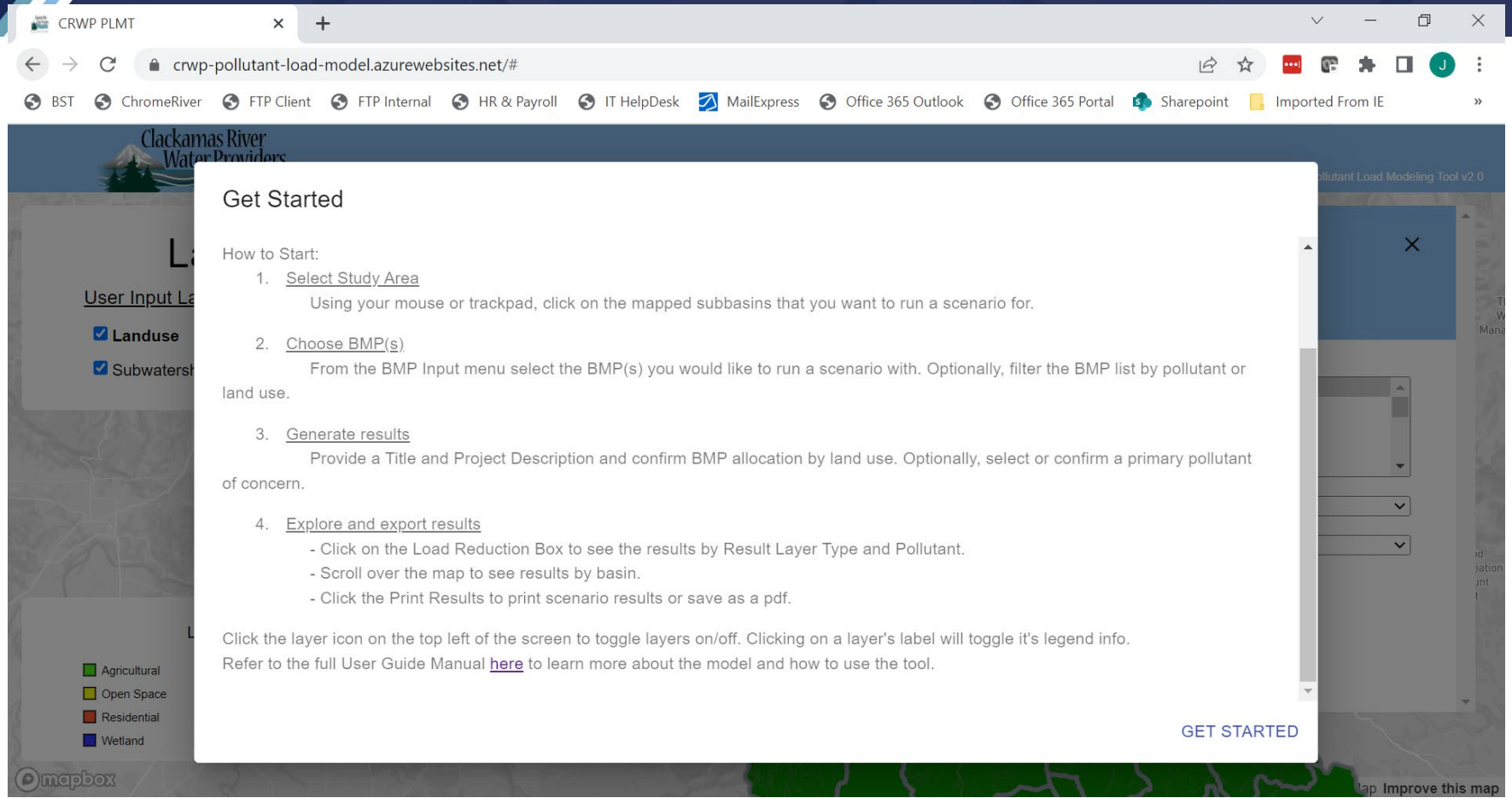

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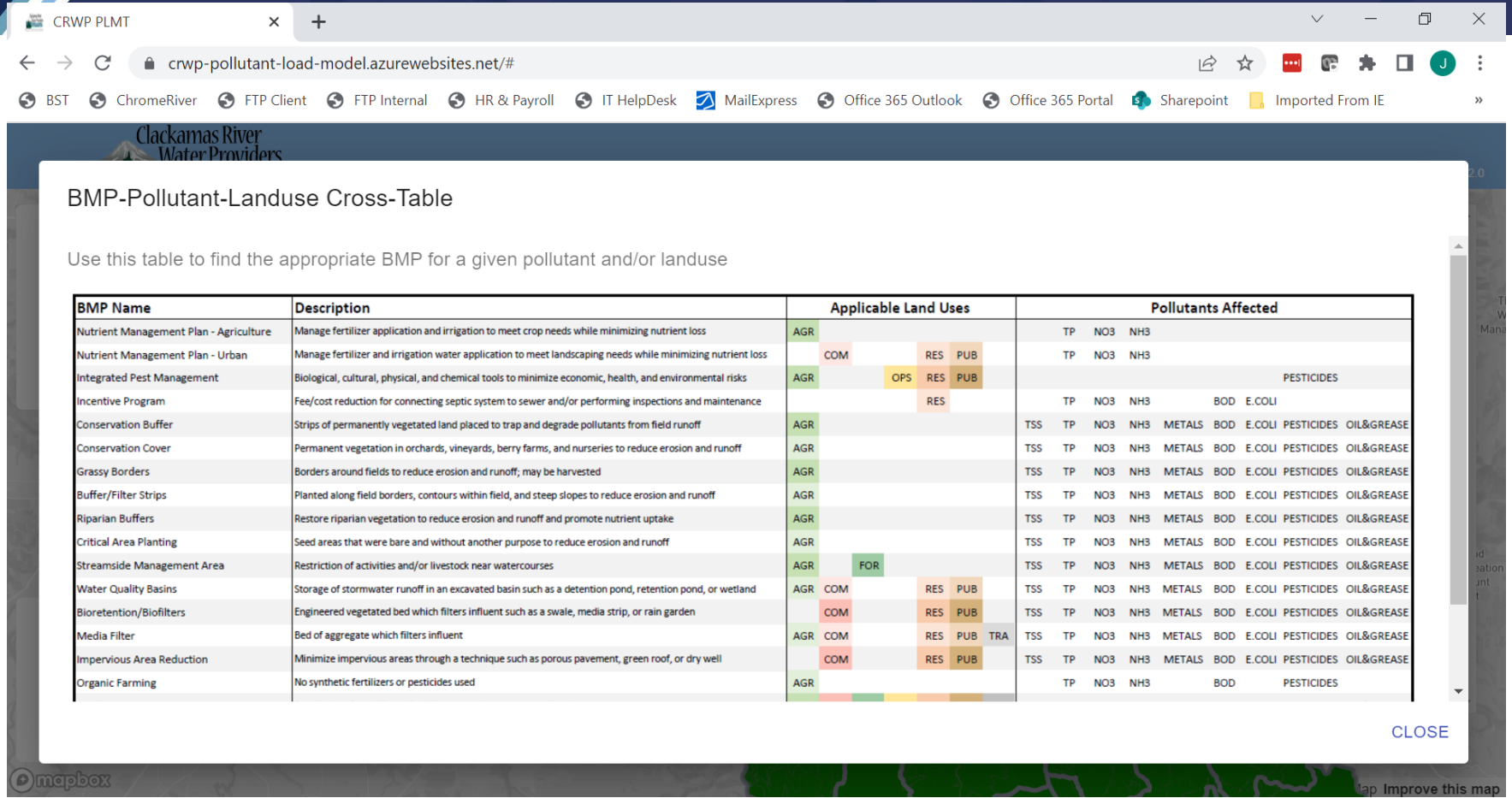

BMP Name	Description	Applicable Land Uses	Pollutants Affected
Nutrient Management Plan - Agriculture	Manage fertilizer application and irrigation to meet crop needs while minimizing nutrient loss	AGR	TP NO3 NH3
Nutrient Management Plan - Urban	Manage fertilizer and irrigation water application to meet landscaping needs while minimizing nutrient loss	COM RES PUB	TP NO3 NH3
Integrated Pest Management	Biological, cultural, physical, and chemical tools to minimize economic, health, and environmental risks	AGR OPS RES PUB	PESTICIDES
Incentive Program	Fee/cost reduction for connecting septic system to sewer and/or performing inspections and maintenance	RES	TP NO3 NH3 BOD E.COLI
Conservation Buffer	Strips of permanently vegetated land placed to trap and degrade pollutants from field runoff	AGR	TSS TP NO3 NH3 METALS BOD E.COLI PESTICIDES OIL&GREASE
Conservation Cover	Permanent vegetation in orchards, vineyards, berry farms, and nurseries to reduce erosion and runoff	AGR	TSS TP NO3 NH3 METALS BOD E.COLI PESTICIDES OIL&GREASE
Grassy Borders	Borders around fields to reduce erosion and runoff; may be harvested	AGR	TSS TP NO3 NH3 METALS BOD E.COLI PESTICIDES OIL&GREASE
Buffer/Filter Strips	Planted along field borders, contours within field, and steep slopes to reduce erosion and runoff	AGR	TSS TP NO3 NH3 METALS BOD E.COLI PESTICIDES OIL&GREASE
Riparian Buffers	Restore riparian vegetation to reduce erosion and runoff and promote nutrient uptake	AGR	TSS TP NO3 NH3 METALS BOD E.COLI PESTICIDES OIL&GREASE
Critical Area Planting	Seed areas that were bare and without another purpose to reduce erosion and runoff	AGR	TSS TP NO3 NH3 METALS BOD E.COLI PESTICIDES OIL&GREASE
Streamside Management Area	Restriction of activities and/or livestock near watercourses	AGR FOR	TSS TP NO3 NH3 METALS BOD E.COLI PESTICIDES OIL&GREASE
Water Quality Basins	Storage of stormwater runoff in an excavated basin such as a detention pond, retention pond, or wetland	AGR COM RES PUB	TSS TP NO3 NH3 METALS BOD E.COLI PESTICIDES OIL&GREASE
Bioretention/Biofilters	Engineered vegetated bed which filters influent such as a swale, media strip, or rain garden	COM RES PUB	TSS TP NO3 NH3 METALS BOD E.COLI PESTICIDES OIL&GREASE
Media Filter	Bed of aggregate which filters influent	AGR COM RES PUB TRA	TSS TP NO3 NH3 METALS BOD E.COLI PESTICIDES OIL&GREASE
Impervious Area Reduction	Minimize impervious areas through a technique such as porous pavement, green roof, or dry well	COM RES PUB	TSS TP NO3 NH3 METALS BOD E.COLI PESTICIDES OIL&GREASE
Organic Farming	No synthetic fertilizers or pesticides used	AGR	TP NO3 NH3 BOD PESTICIDES

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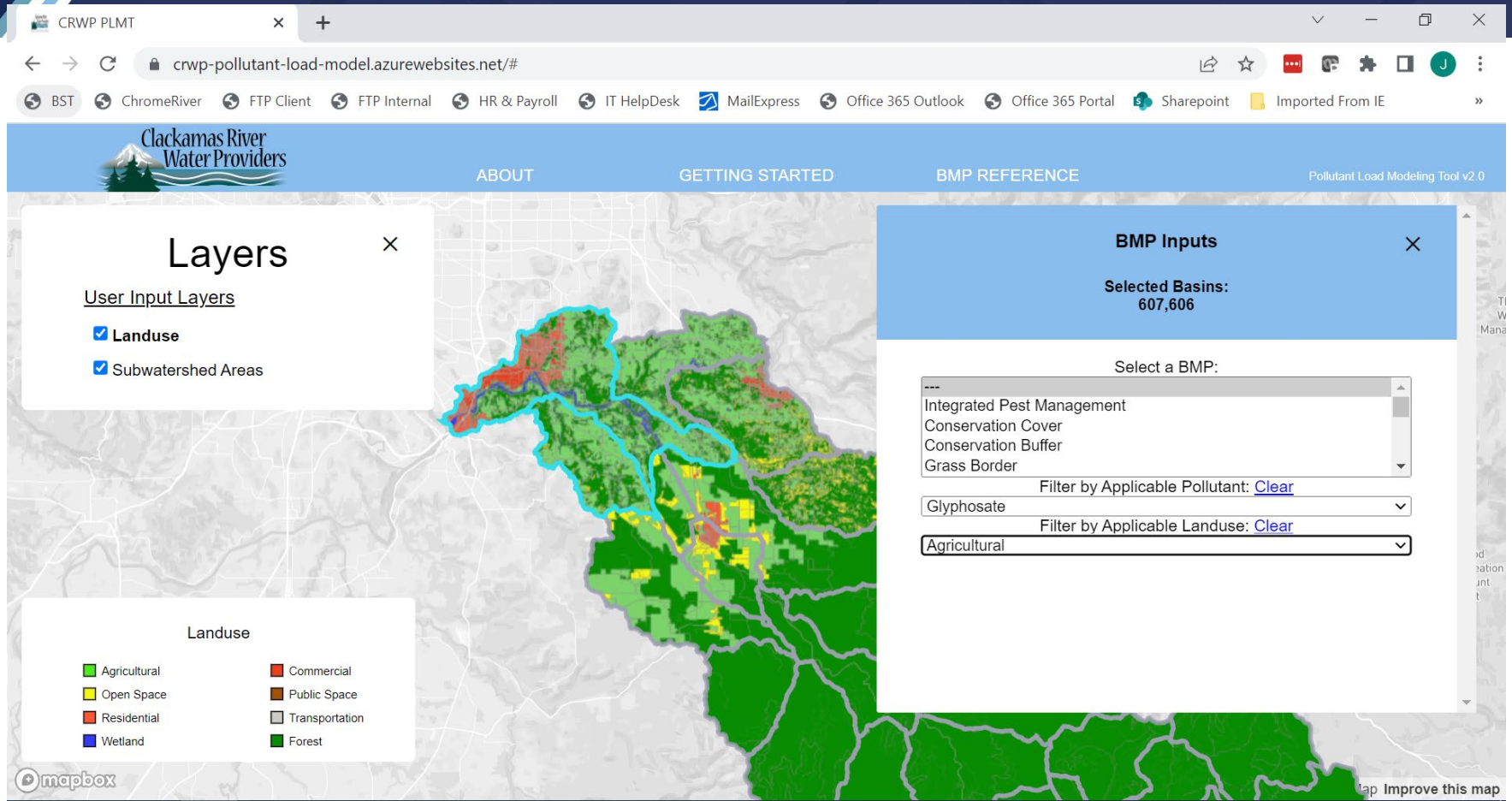

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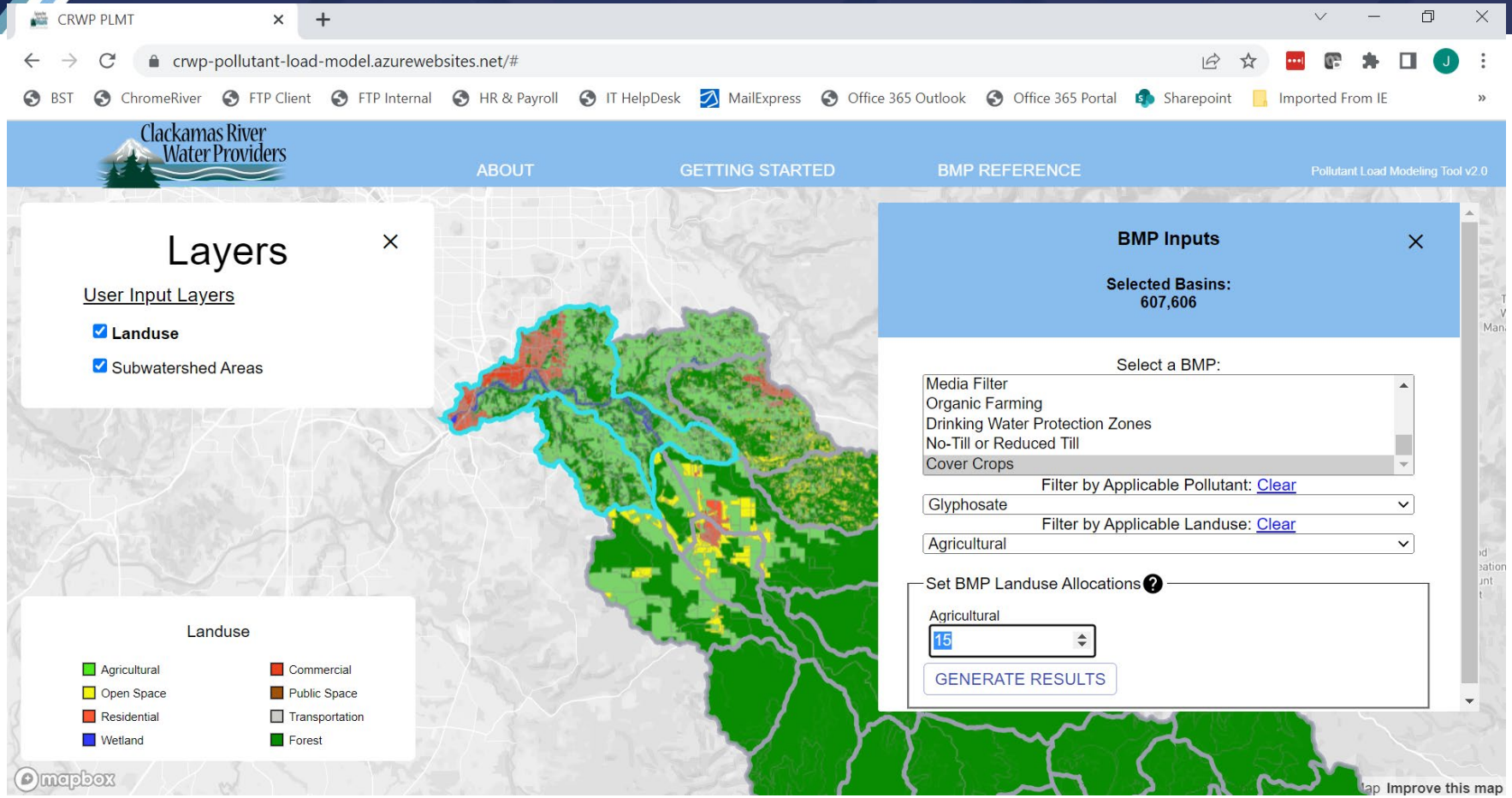

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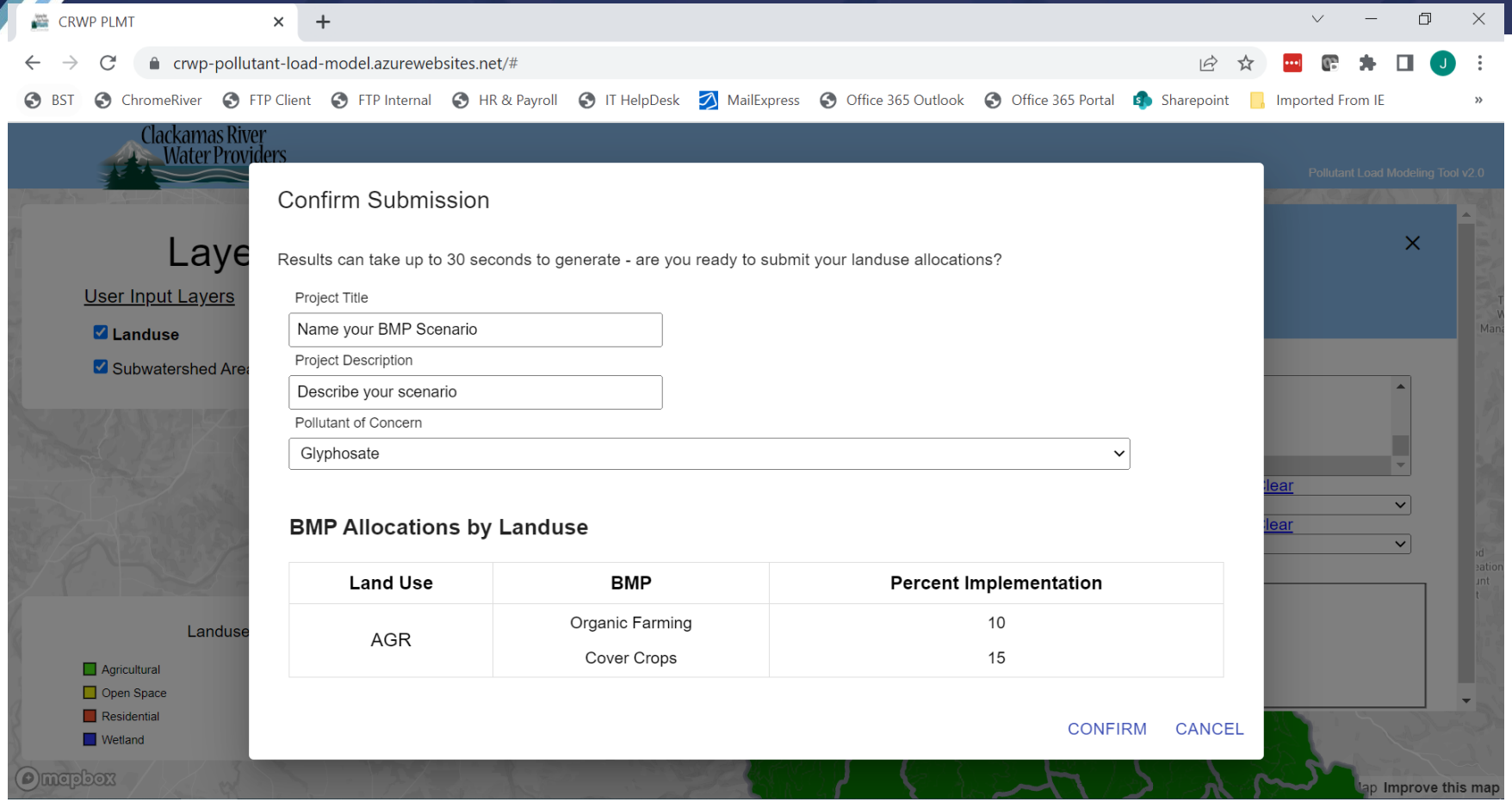

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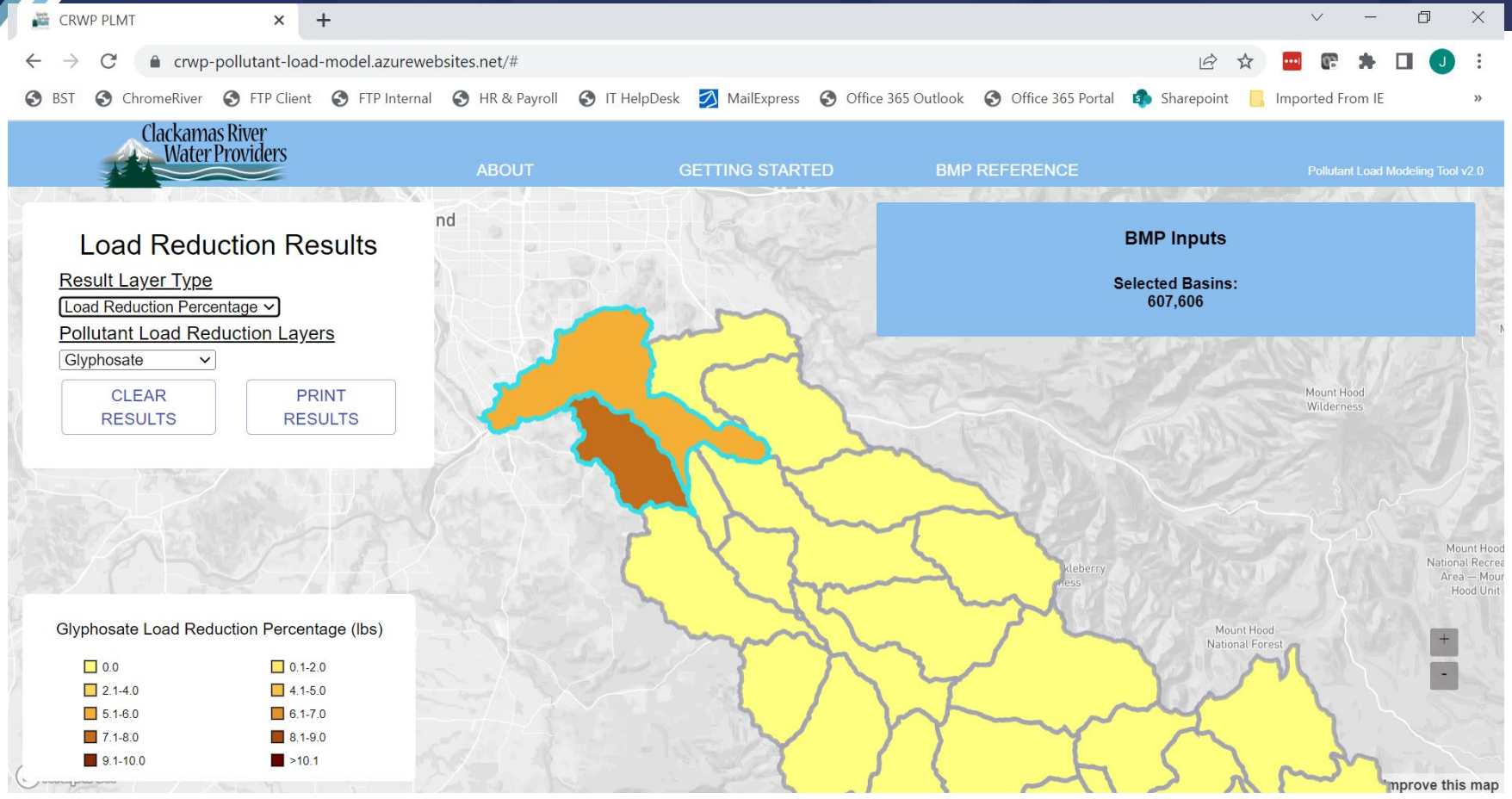

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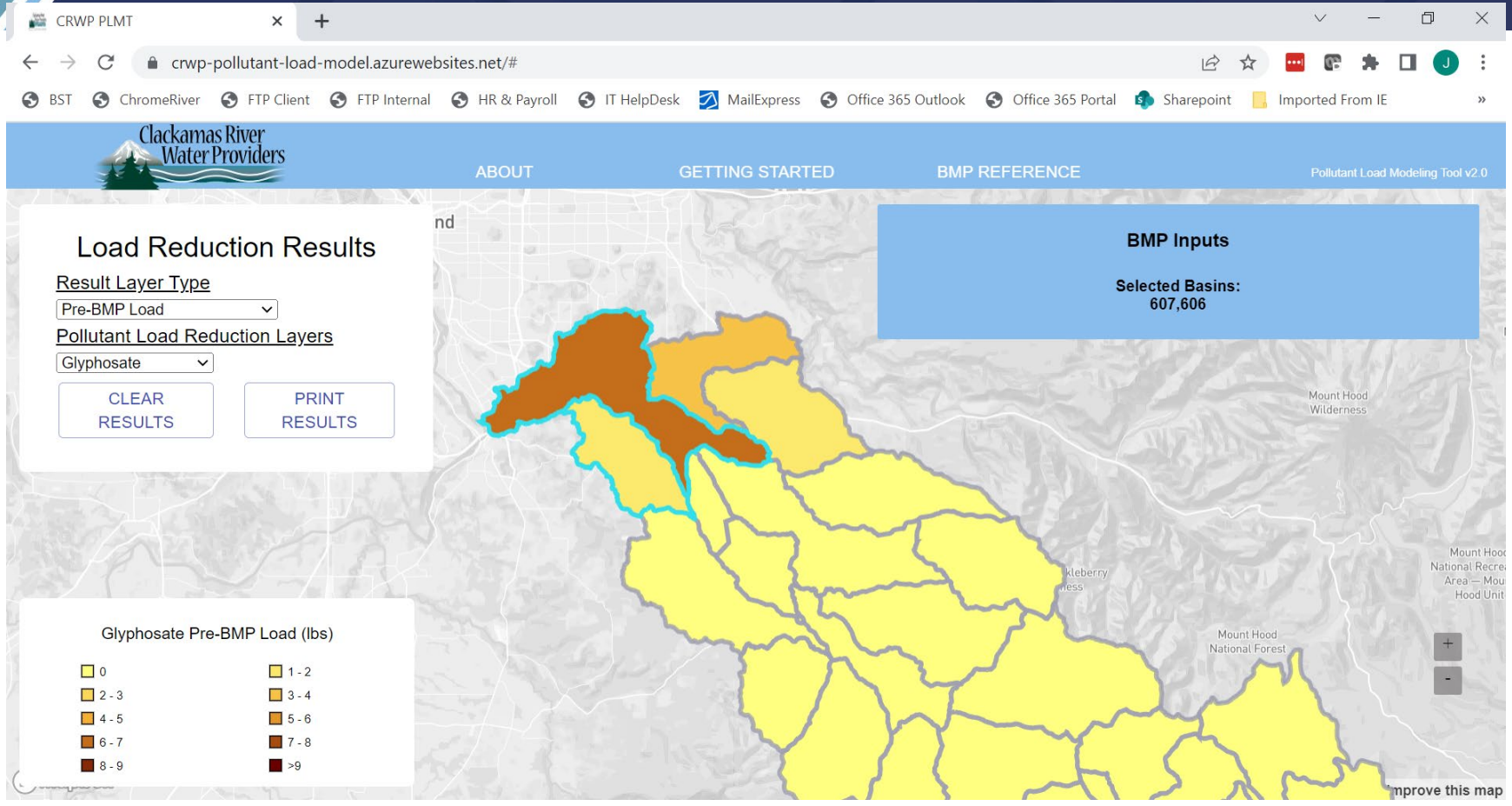

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