



FloodFX Economic Appraisal Using FME

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JACOBS®

OVERVIEW

1. **The challenge** – economic appraisal
2. **The solution** – FloodFX
3. **The approach** – FME Tools





THE CHALLENGE: Economic Appraisal



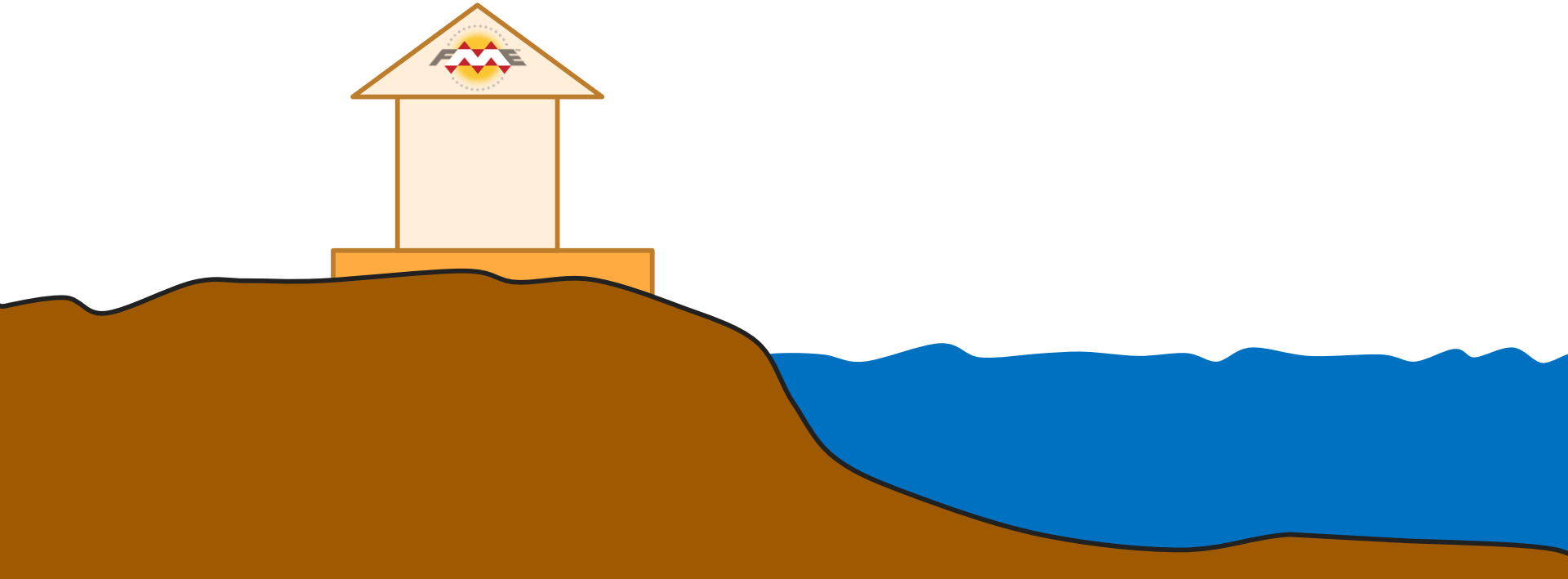
BENEFITS vs. COST

Why economic appraisal of stormwater infrastructure?

- CCC Land Drainage Recovery Programme
 - Earthquake land damage has increased flood risk
 - Group of flood events in 2014
 - Climate change and sea level rise
 - Establish common appraisal standard across Christchurch
- Benefits should outweigh mitigation costs
- Funds shall be used to maximise social welfare



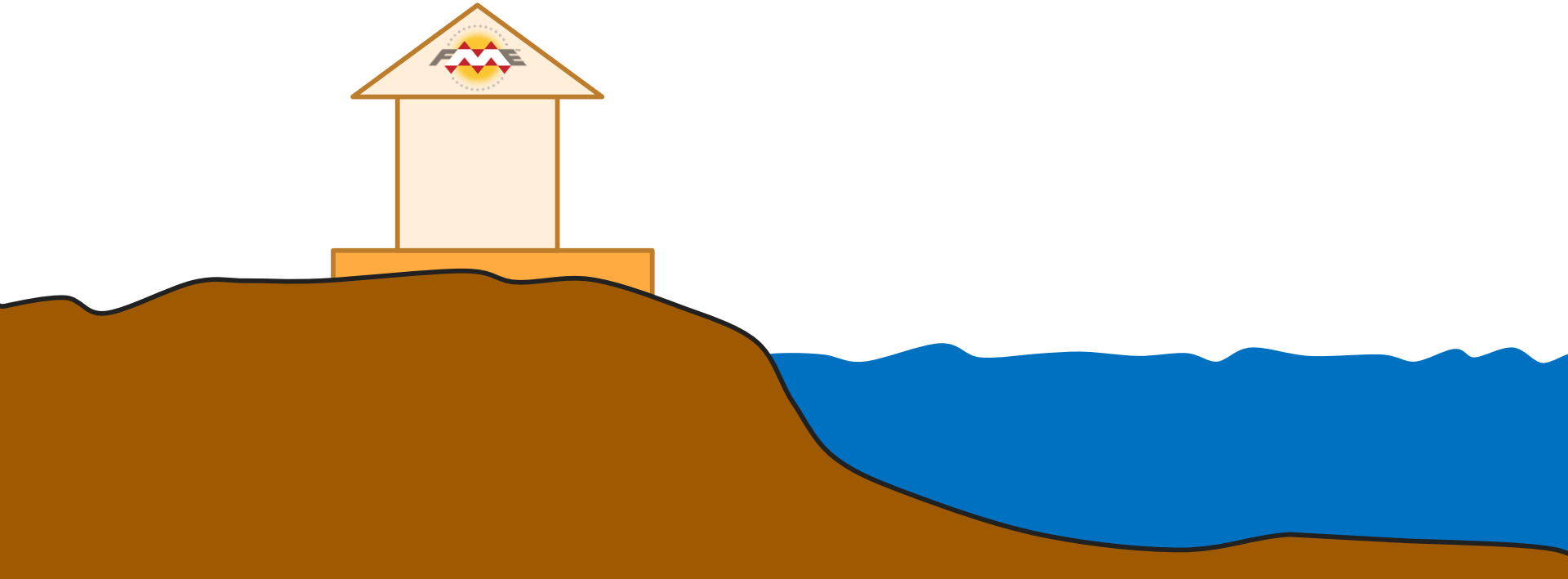
BENEFITS vs. COST



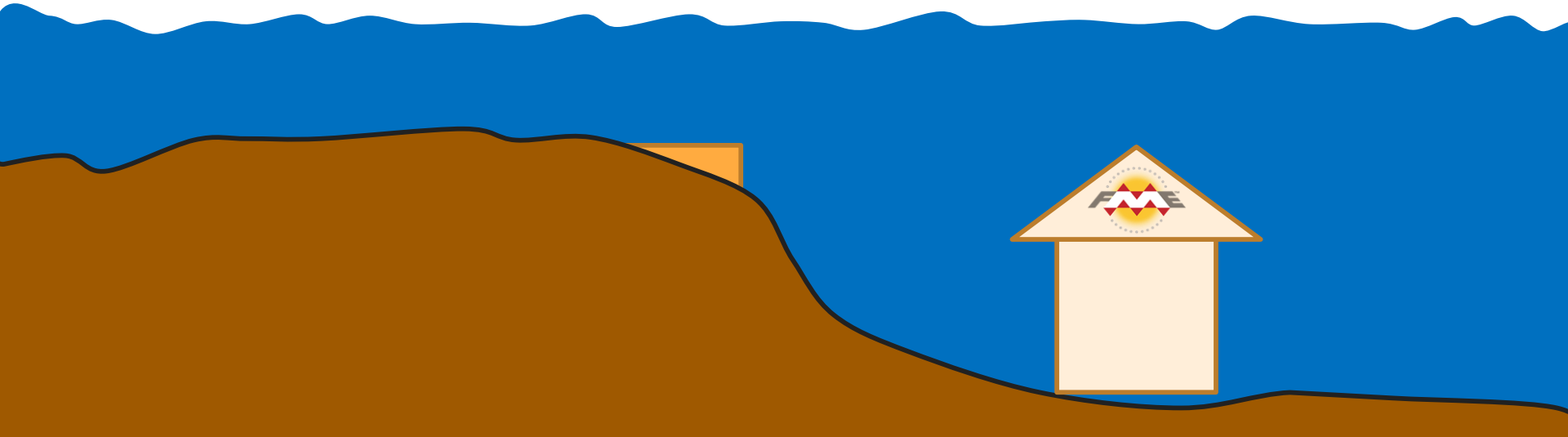
BENEFITS vs. COST



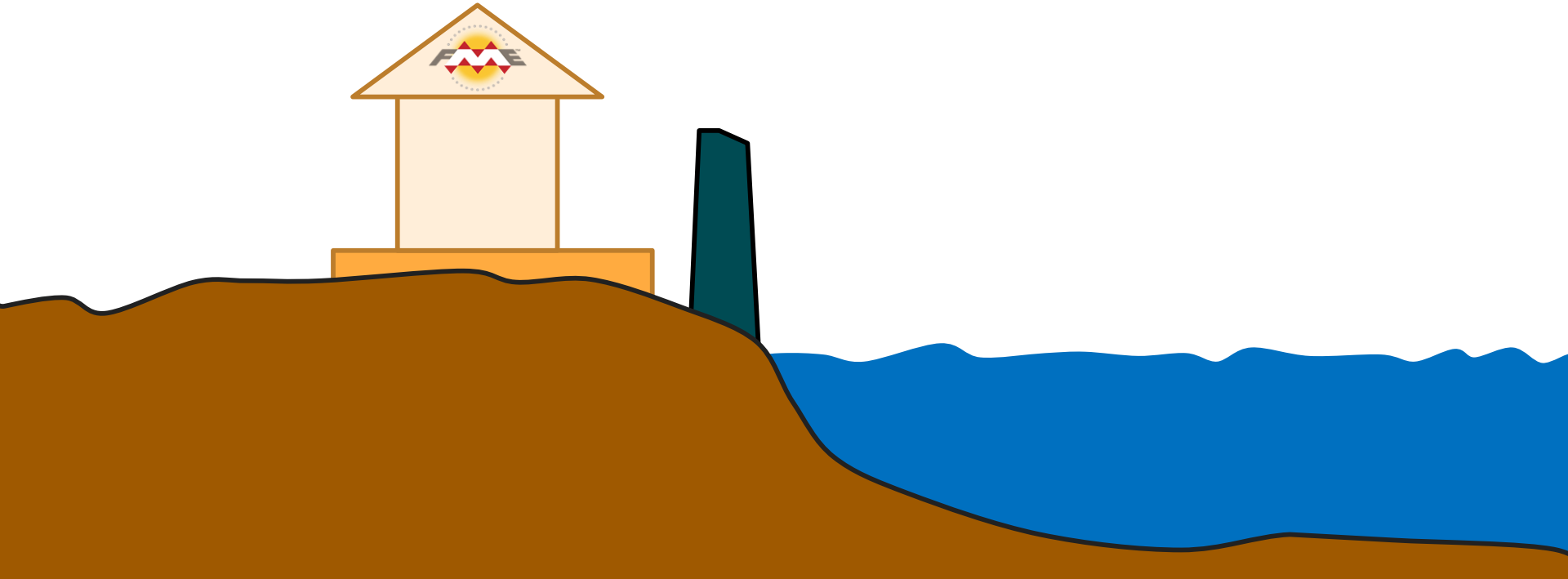
BENEFITS vs. COST



BENEFITS vs. COST



BENEFITS vs. COST



BENEFITS vs. COST



BENEFITS vs. COST





THE SOLUTION: **FloodFX**



WHAT DOES FloodFX



Economic appraisal tool that calculates:

- Flood related damages

| Direct Damage | | Indirect Damage | |
|--|--|---|---|
| Tangible | Intangible | Tangible | Intangible |
| Property, land value, goods, infrastructure, utilities | Health and life, irreplaceable items, ecosystems | Accommodation, travel, clean up, emergency services, production and income loss | Inconvenience caused by disruption of services, utilities, infrastructure |

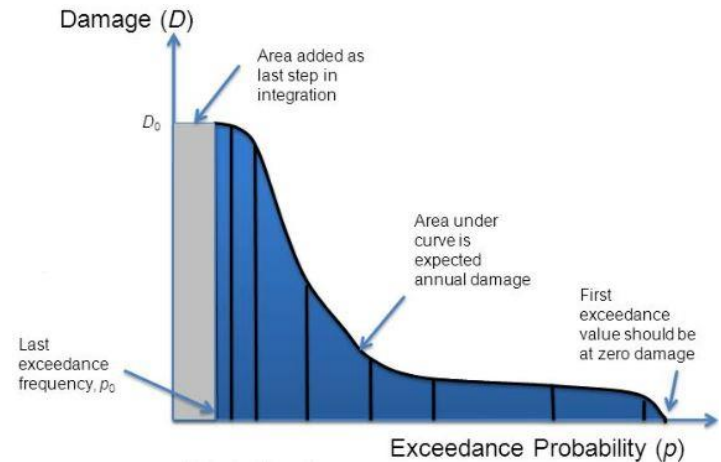
WHAT DOES FloodFX

Economic appraisal tool that calculates:

- Average Annual Damage
- Present Value (determines present value of future damage)
- Damages classified by residential / non-residential buildings
- **Benefits using intervention costs, cost benefit ratio**



Probability Damage Curve

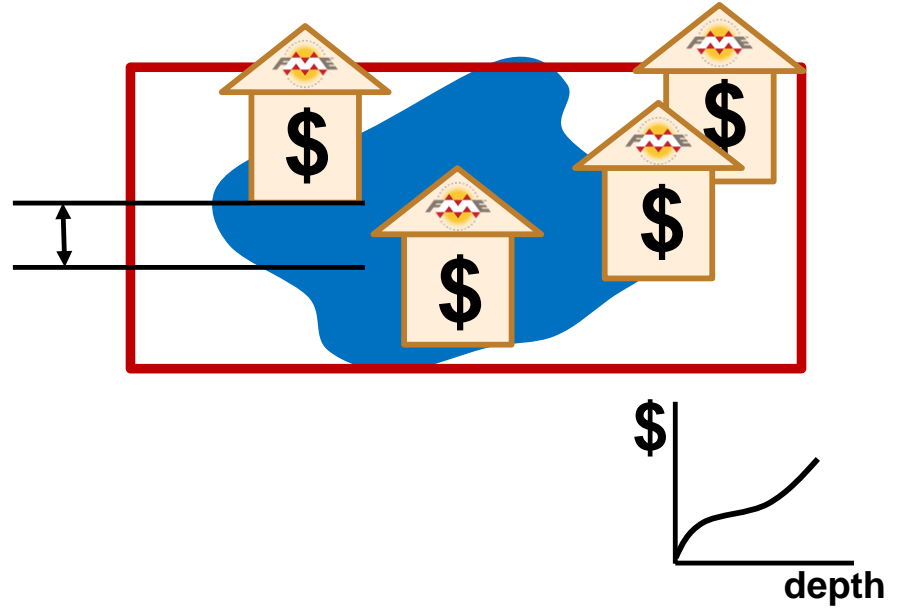


DC McKinney (<http://slideplayer.com/slide/4571457/>)



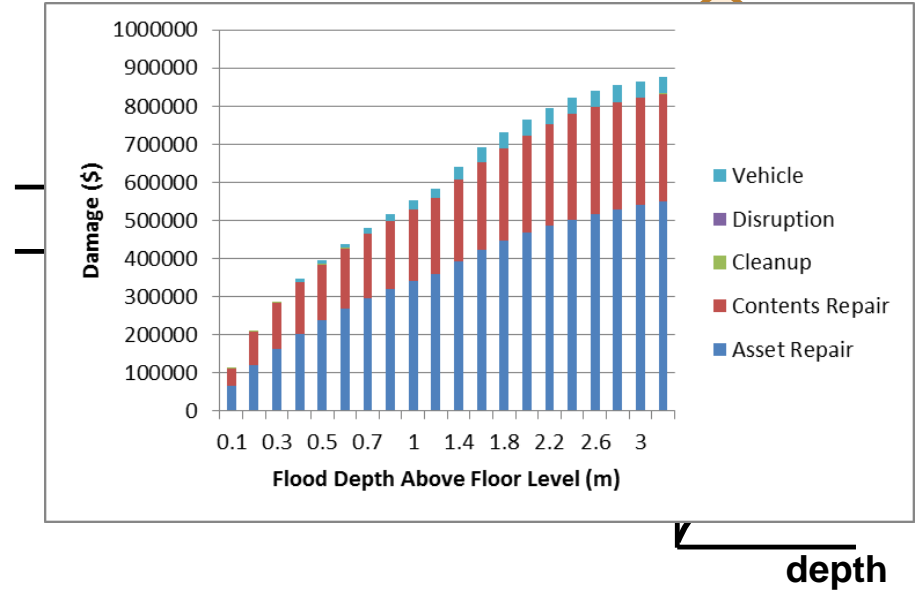
FloodFX BASE DATA

- Classified buildings dataset
- Building floor level data
- Property value data
- NIWA RiskScape flood depth-damage curves (property based)
- Hydraulic model outputs (polygon or raster data)
- AOI polygons



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FLOODFX: DECISION MAKING



THE APPROACH: FME Tools



FloodFX FME TOOLS



Upload Flood Model Data
(polygon data)



Upload Flood Model Data
(raster data)

Upload and pre-process
model data to FME
Server storage



FloodFX
Economic appraisal.



Delete Dataset



Subset Dataset



Batch run FloodFX

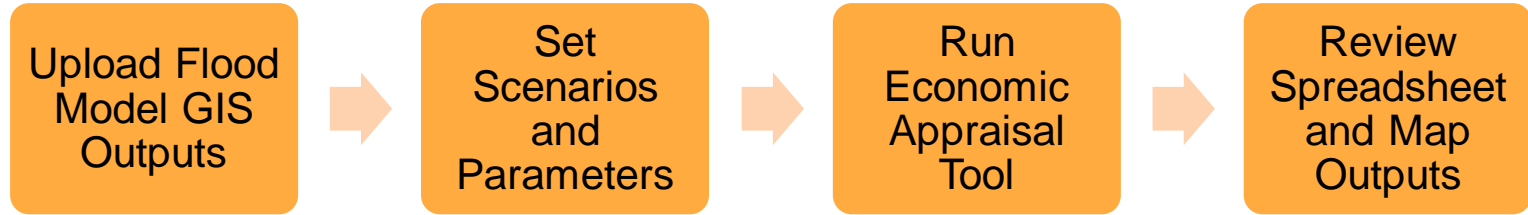


Purge Datasets
and outputs

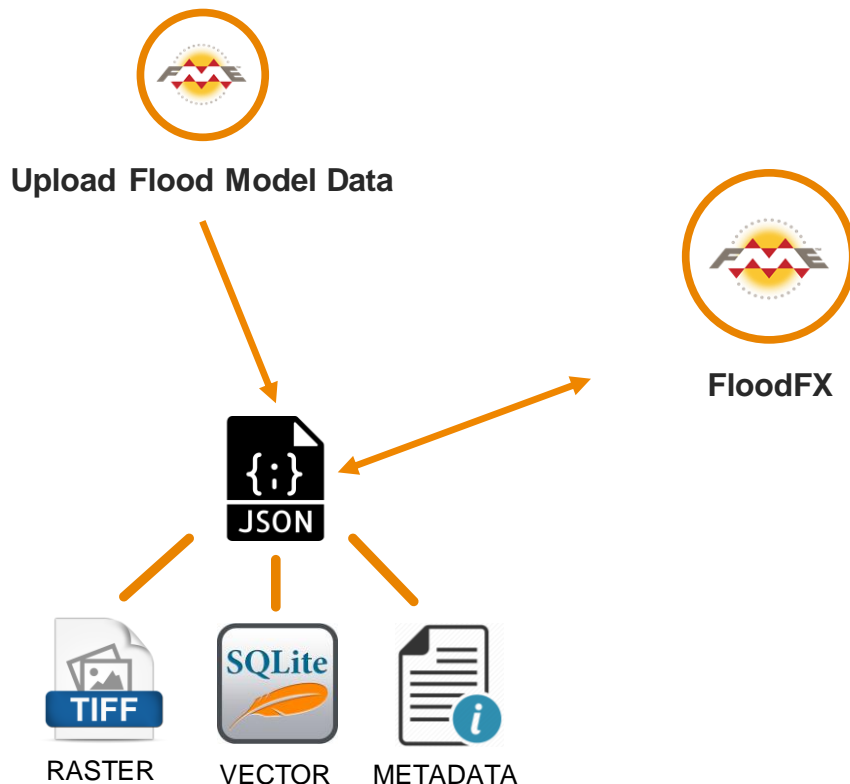


Download Dataset

FloodFX FME TOOLS



FloodFX DATASETS

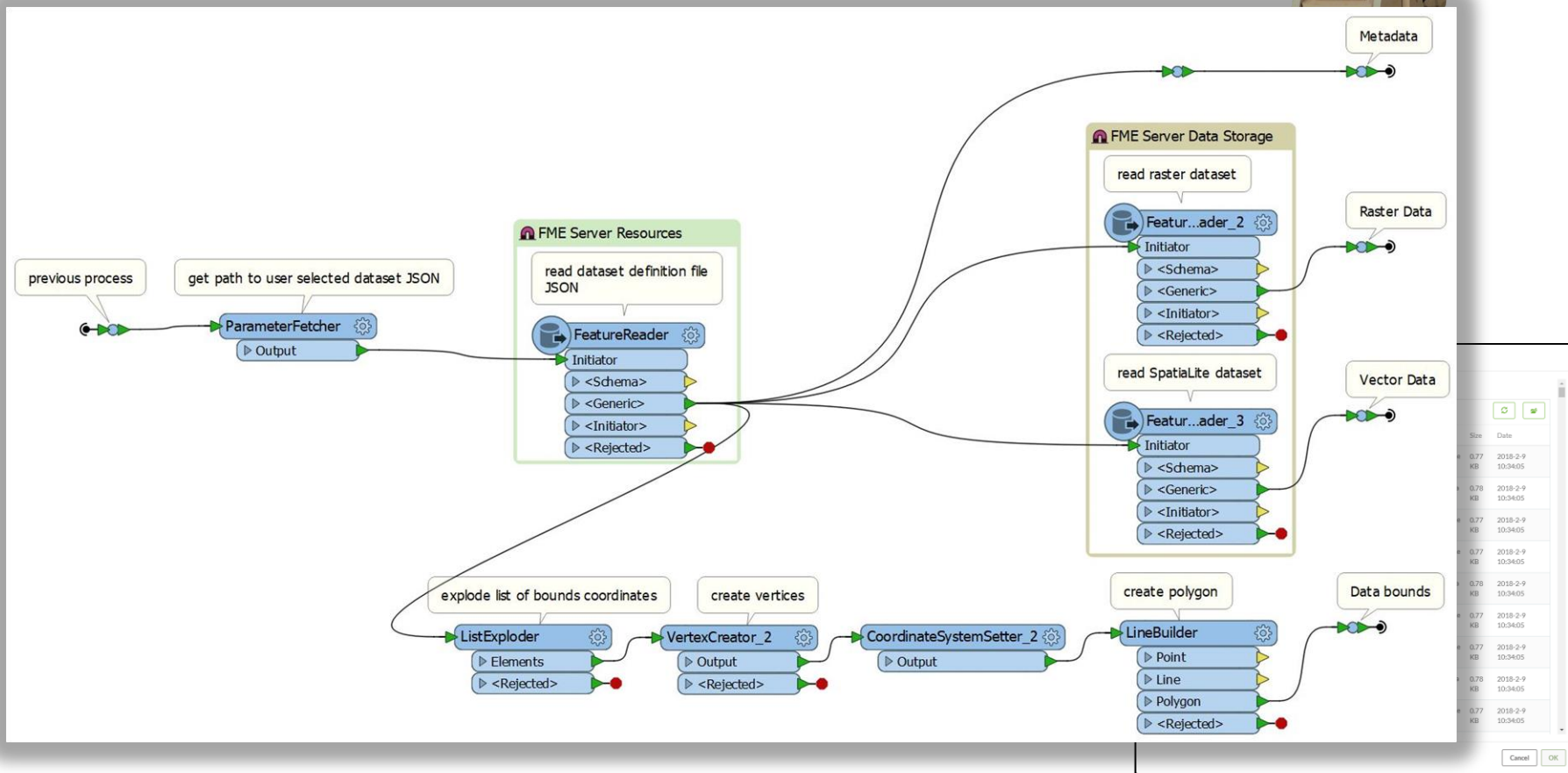
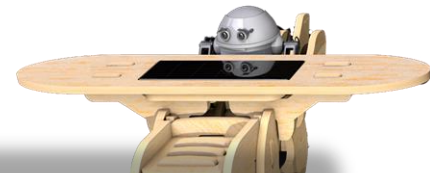


Select file for Event 1 Baseline: Model data

| Resources | | Temporary Uploads | |
|--|---------|-------------------|--|
| Home > Data | | | |
| Name | Size | Date | |
| AvonCWM#tile1488_BC_10yr_20170619194451_Avon_PostEQ_ED2014_10AEP_MaxMax_Level_cleaned | 0.77 KB | 2018-2-9 10:34:05 | |
| AvonCWM#tile1488_BC_200yr_20170619214408_Avon_PostEQ_ED2014_00p5AEP_MaxMax_Level_cleaned | 0.78 KB | 2018-2-9 10:34:05 | |
| AvonCWM#tile1488_BC_50yr_20170619201218_Avon_PostEQ_ED2014_02AEP_MaxMax_Level_cleaned | 0.77 KB | 2018-2-9 10:34:05 | |
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Cancel OK

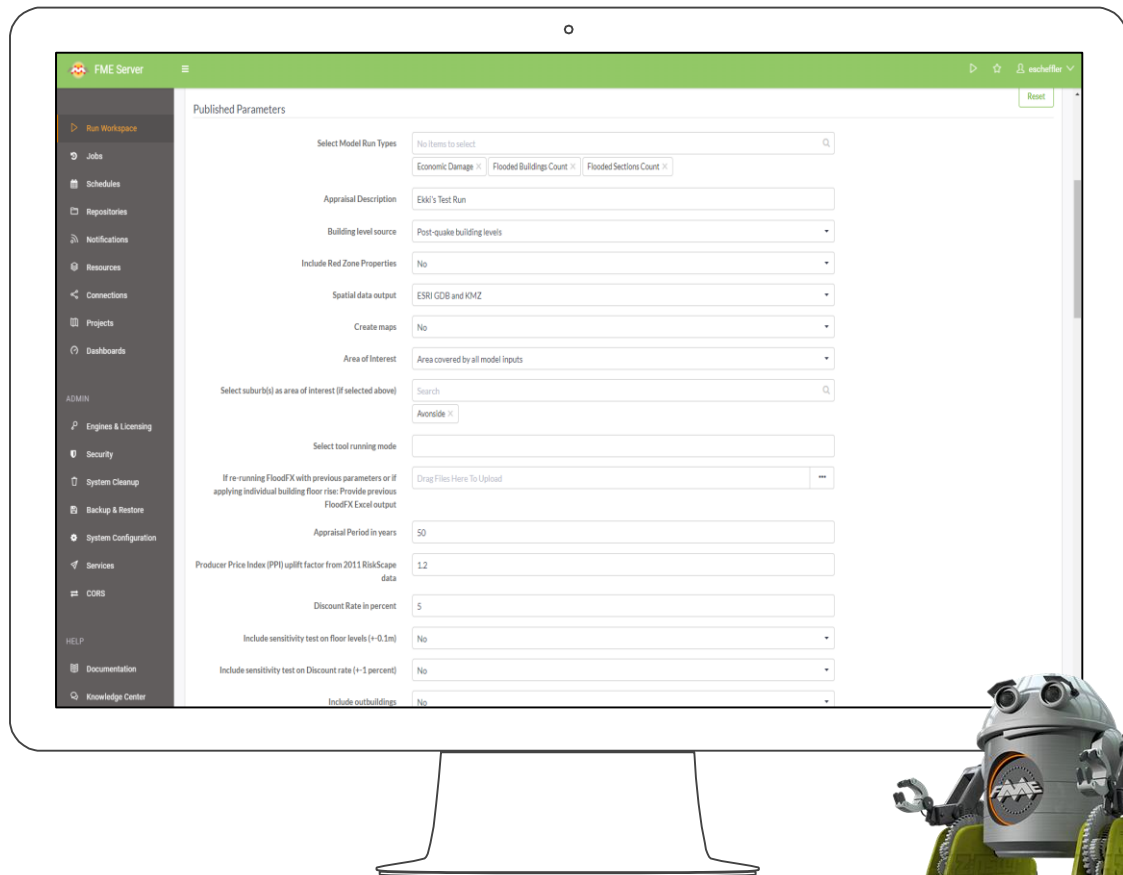
FloodFX DATASETS





FloodFX

- Up to 6 probability events
- Base case and up to 2 interventions
- Sensitivity tests on floor levels and discount rate



FloodFX REPEATS

62 published param.
(49 private param.)

Re-run tool by amending previous output



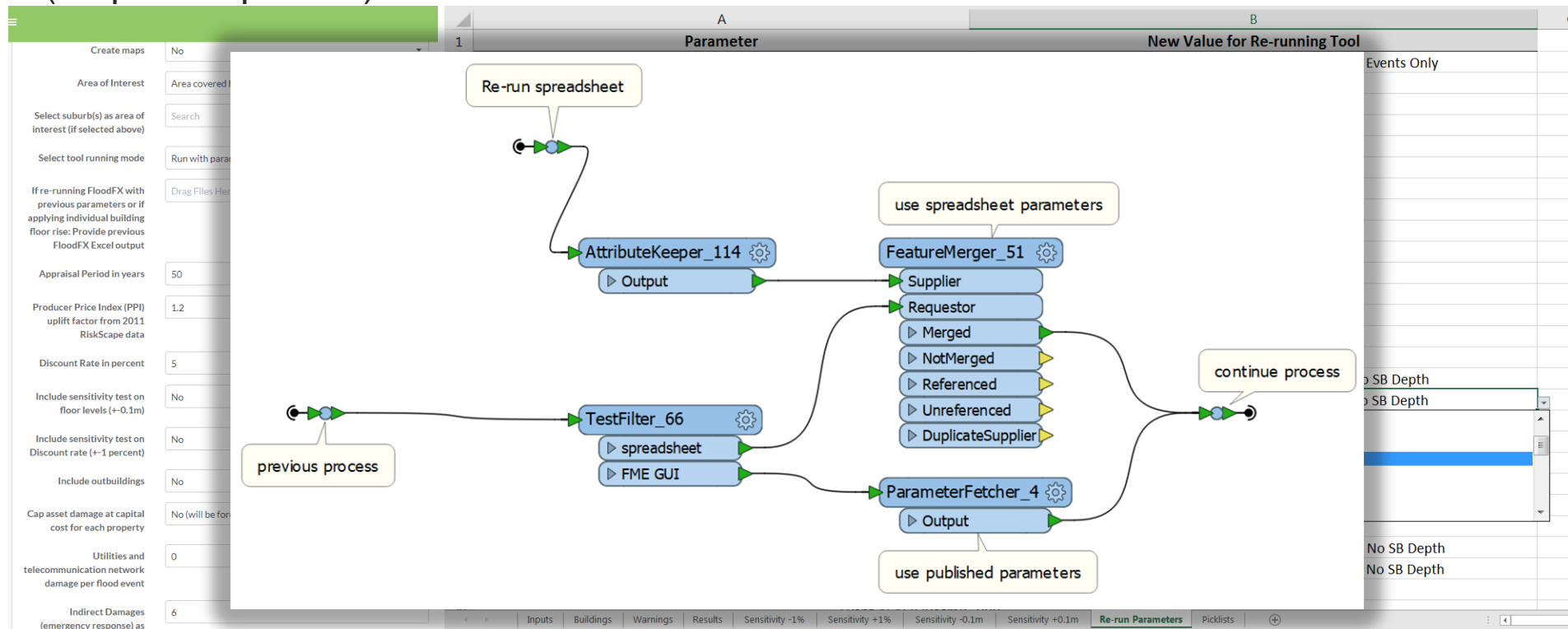
| Create maps | | No |
|---|--|---|
| Area of Interest | | Area covered by all model inputs |
| Select suburb(s) as area of interest (if selected above) | | Search |
| Select tool running mode | | Run with parameters from this form |
| If re-running FloodFX with previous parameters or if applying individual building floor rise: Provide previous FloodFX Excel output | | Drag Files Here To Upload |
| Appraisal Period in years | | 50 |
| Producer Price Index (PPI) uplift factor from 2011 RiskScape data | | 1.2 |
| Discount Rate in percent | | 5 |
| Include sensitivity test on floor levels (+/-0.1m) | | No |
| Include sensitivity test on Discount rate (+/-1 percent) | | No |
| Include outbuildings | | No |
| Cap asset damage at capital cost for each property | | No (will be forced to Yes if outbuildings included) |
| Utilities and telecommunication network damage per flood event | | 0 |
| Indirect Damages (emergency response) as | | 6 |

| A | B |
|-----------|---|
| Parameter | New Value for Re-running Tool |
| 1 | Appraisal Description: Avon River Basecase Comparison with Climate Change (2050) 3 Events Only |
| 2 | Area of Interest: model |
| 3 | Suburb (if selected above): |
| 4 | Appraisal Period in years: 100 |
| 5 | Producer Price Index (PPI) uplift factor from 2011 RiskScape data: 1.17 |
| 6 | Discount Rate in percent: 5 |
| 7 | Include sensitivity test on floor levels (+/-0.1m): Yes |
| 8 | Include sensitivity test on Discount rate (+/-1 percent): Yes |
| 9 | Include outbuildings: No |
| 10 | Cap asset damage at capital cost for each property: Yes |
| 11 | Utilities and telecommunication network damage per flood event: 0 |
| 12 | Indirect Damages (emergency response) as percent of Direct Damage: 6 |
| 13 | Intangible Damages as percent of Direct Damage: 100 |
| 14 | Flood model data parameters below |
| 15 | Event 1: AEP (years): 10 |
| 16 | Event 1 Baseline: Model data: BC, 10 year event, uploaded 20160905115539, Avon 10y ED No SB Depth |
| 17 | Event 1 Intervention 1: Model data: BC, 10 year event, uploaded 20160906113447, Avon 10y CC No SB Depth |
| 18 | Event 1 Intervention 2: Model data: BC, 10 year event, uploaded 20160906113447, Avon 10y CC No SB Depth |
| 19 | Event 2: AEP (years): 100 |
| 20 | Event 2 Baseline: Model data: BC, 100 year event, uploaded 20160906114308, Avon 100y CC No SB Depth |
| 21 | Event 2 Intervention 1: Model data: BC, 100 year event, uploaded 20160906114809, Avon 100y ED No SB Depth |
| 22 | Event 2 Intervention 2: Model data: BC, 200 year event, uploaded 20160706134328, Bells Creek Stage 2 Basecase |
| 23 | Event 3: AEP (years): 200 |
| 24 | Event 3 Baseline: Model data: BC, 200 year event, uploaded 20160906120834, Avon 200y ED No SB Depth |
| 25 | Event 3 Intervention 1: Model data: BC, 200 year event, uploaded 20160906113301, Avon 200y CC No SB Depth |
| 26 | Event 3 Intervention 2: Model data: BC, 200 year event, uploaded 20160906120834, Avon 200y ED No SB Depth |
| 27 | Event 3 Intervention 3: Model data: BC, 200 year event, uploaded 20160906120834, Avon 200y ED No SB Depth |

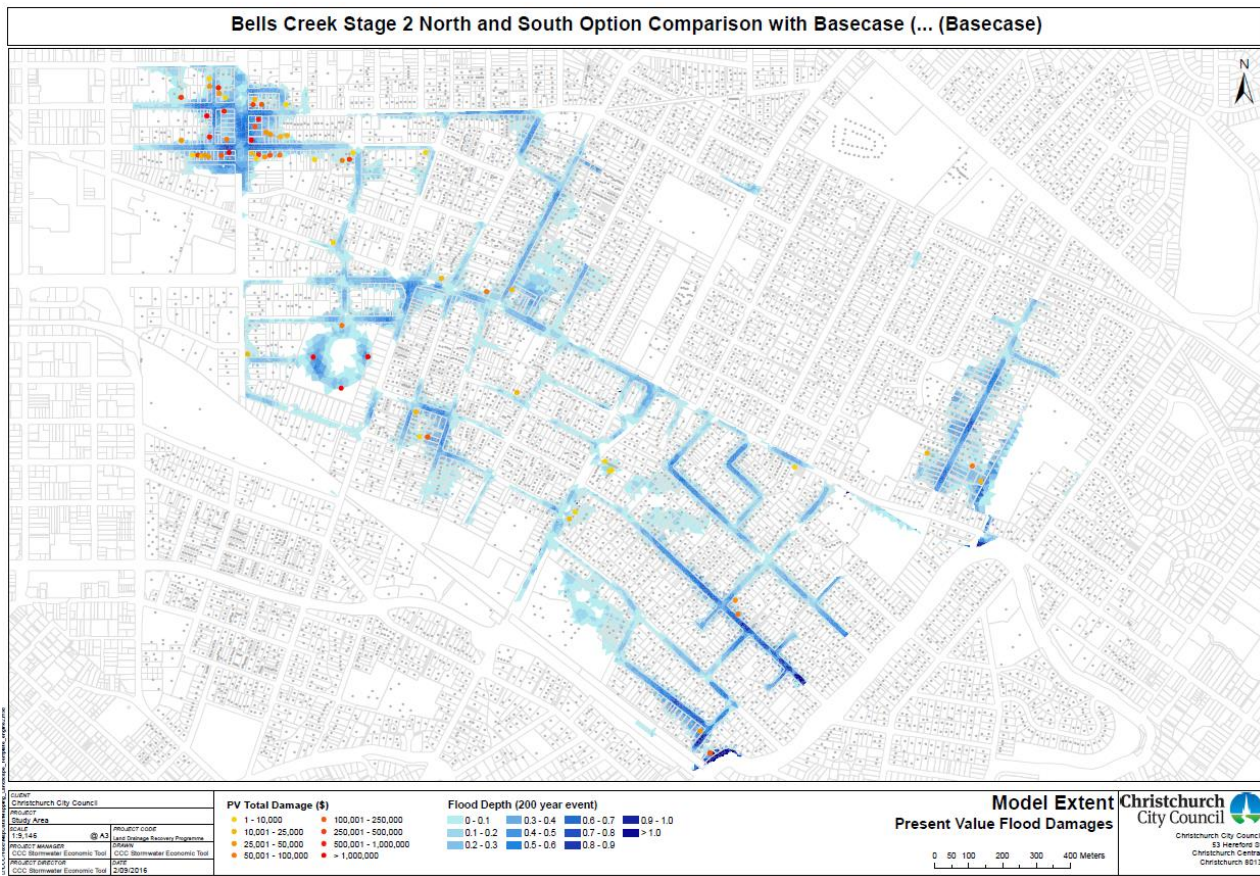
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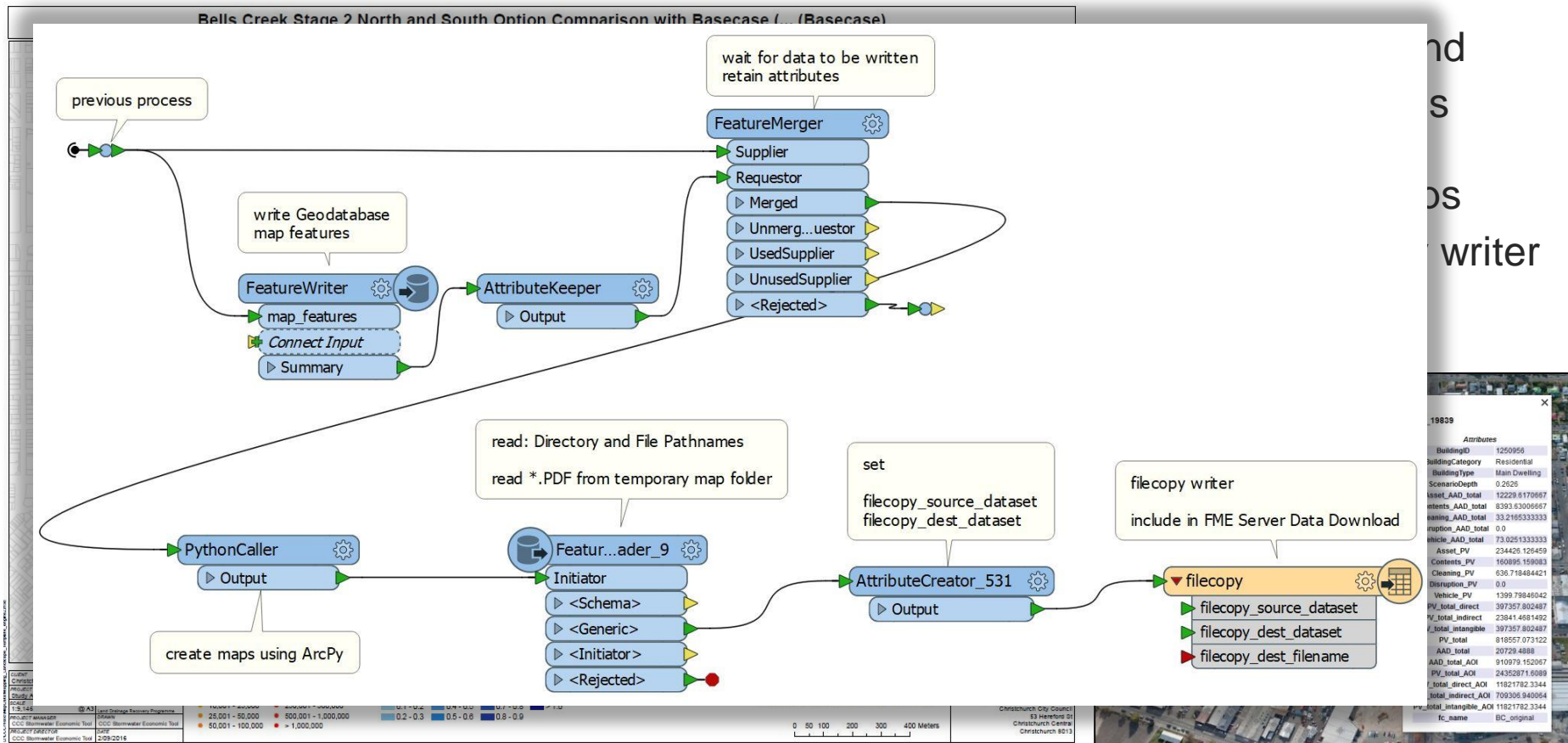
FloodFX OUTPUTS



- ESRI ArcPy and MXD templates
- Download maps using file copy writer



FloodFX OUTPUTS



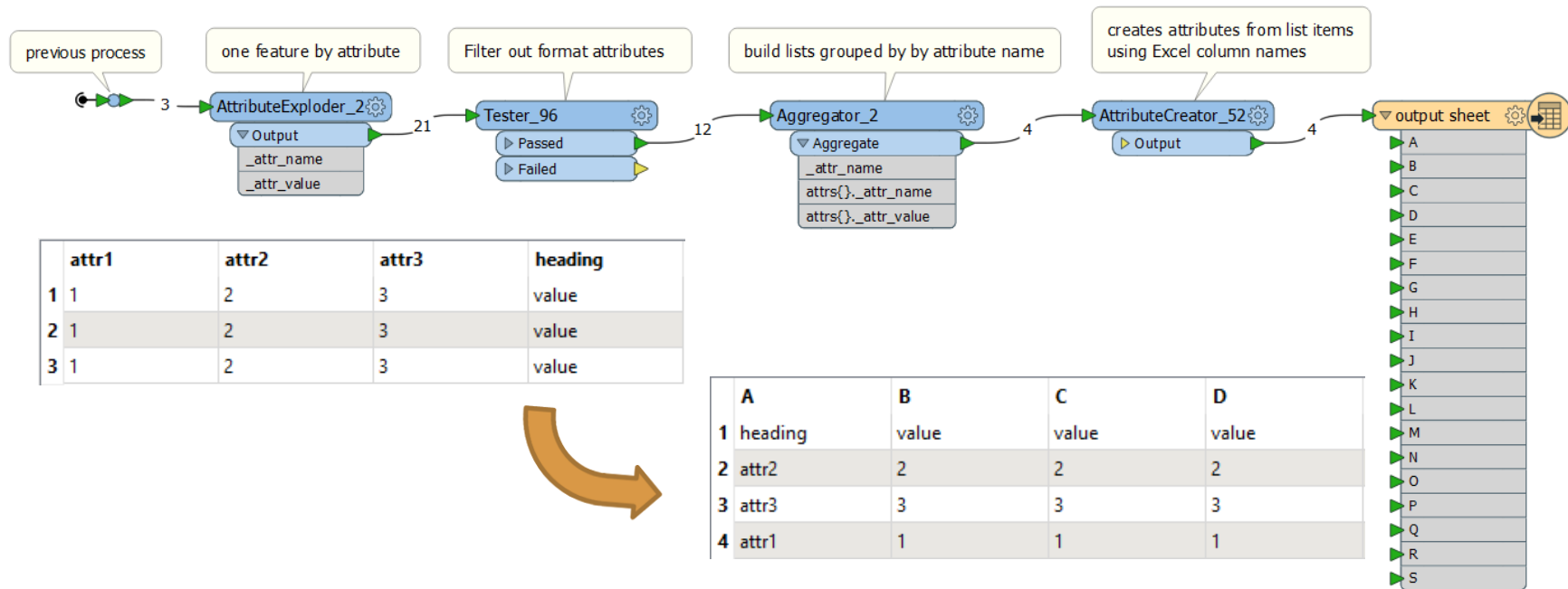
FloodFX OUTPUTS

| | Basecase | Intervention (Single or Staged) | Intervention (Alternative) |
|--|--------------|---------------------------------|----------------------------|
| PV Total Damage | \$15,178,006 | \$11,670,881 | \$6,701,934 |
| PV Total Damage - Non-residential (excl. Network) | \$4,643,772 | \$2,600,296 | \$4,368,742 |
| PV Total Damage - Residential (excl. Network) | \$10,534,234 | \$9,070,585 | \$2,333,192 |
| PV Direct Damage | \$7,367,964 | \$5,665,476 | \$3,253,366 |
| PV Direct Damage - Non-residential | \$2,254,258 | \$1,262,280 | \$2,120,749 |
| PV Direct Damage - Residential | \$5,113,706 | \$4,403,197 | \$1,132,617 |
| PV Indirect Damage | \$442,078 | \$339,929 | \$195,202 |
| PV Indirect Damage - Non-residential | \$135,256 | \$75,737 | \$127,245 |
| PV Indirect Damage - Residential | \$306,822 | \$264,192 | \$67,957 |
| PV Intangible Damage | \$7,367,964 | \$5,665,476 | \$3,253,366 |
| PV Intangible Damage - Non-residential | \$2,254,258 | \$1,262,280 | \$2,120,749 |
| PV Intangible Damage - Residential | \$5,113,706 | \$4,403,197 | \$1,132,617 |
| AAD Total Damage | \$908,451 | | |
| Number residential buildings with damages | 38 | 23 | 25 |
| Average AAD per residential building | \$16,592 | | |
| Average PV Total Damage per residential building | \$277,217 | \$394,373 | \$93,328 |
| Number non-residential buildings with damages | 17 | 14 | 13 |
| Average AAD per non-residential building | \$16,350 | | |
| Average PV Total Damage per non-residential building | \$273,163 | \$185,735 | \$336,057 |
| PV Total residential damages removed by capping | \$4,073,285 | \$4,046,354 | \$2,690 |
| PV Total non-residential damages removed by capping | \$0 | \$0 | \$0 |
| Capital Cost | | \$3,478,000 | \$6,087,000 |
| Maintenance Cost | | \$0 | \$0 |
| Recurring Investment Cost | | \$0 | \$0 |
| Residual Value | | \$0 | \$0 |
| Total PV Cost | | \$3,478,000 | \$6,087,000 |
| Benefits (Damages Avoided) | N/A | \$3,507,125 | \$8,476,072 |
| Net Present Value | N/A | \$29,125 | \$2,389,072 |
| Benefit:Cost Ratio | N/A | 1.0 | 1.4 |
| Incremental Benefit:Cost Ratio | N/A | | 1.9 |

- Excel templates
- Transpose outputs

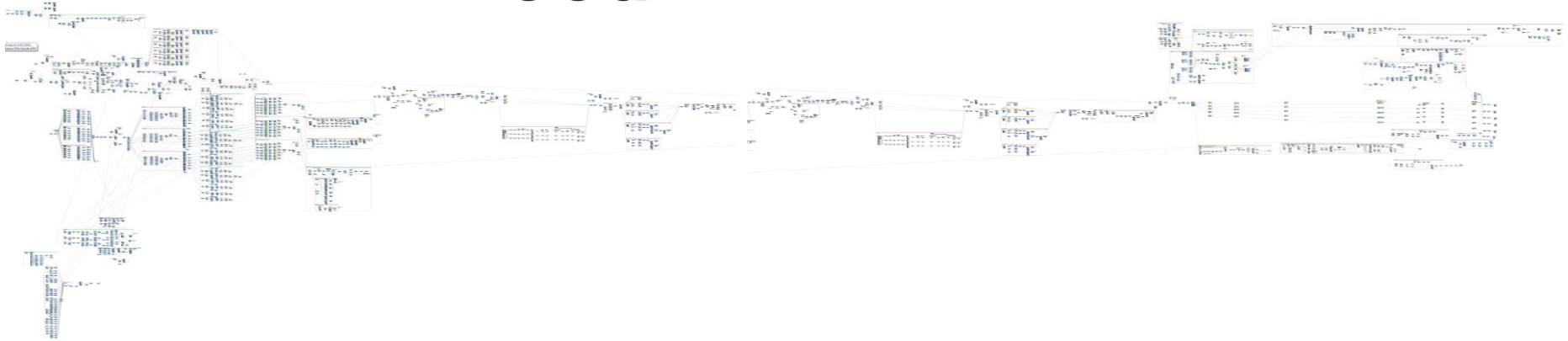
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lates

FloodFX



IMPROVEMENTS



- FloodFX website
- User interface using FME Server API
- Improved dataset and user management



THANK YOU!

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