SDX

User Guide

Hydrology, stormwater and storm drain design
to the Riverside County FCD & WCD manuals

Draft for review · October 2026 · Illustrated
Describes SDX as of October 5, 2026

This guide explains how to set up a project in SDX, run the hydrology and hydraulics, and generate a hydrology study. The chapters follow the order of a typical project. Appendix A walks through a complete project from start to finish. Read Chapter 3 before your first report. SDX writes parts of the report narrative from your Project Setup entries, and those entries need to be worded a certain way.

1 Getting started
2 Starting, saving and importing projects
3 Project Setup and the auto-draft
4 Hydrology
5 Stormwater
6 Storm Drain
7 Drainage Capacity
8 The report
9 Tools
10 Troubleshooting
A Quick start: a complete project
B Wording cheat sheet
C Readiness items, A to Z
D Buttons and windows

1 Getting started

This chapter covers signing in, the home screen, moving between apps, and display settings.

The first time: activate your license

1. Go to sdxstorm.com and click **Sign in**, then **Activate your license**.
2. Enter your email, paste the license key from your email into **License key**, and choose a password of at least 10 characters. Common passwords that have shown up in leaks are not accepted.
3. Click **Activate**. SDX opens on the home screen.

The key is only needed this once. A license is tied to the email it was activated with.

Sign in

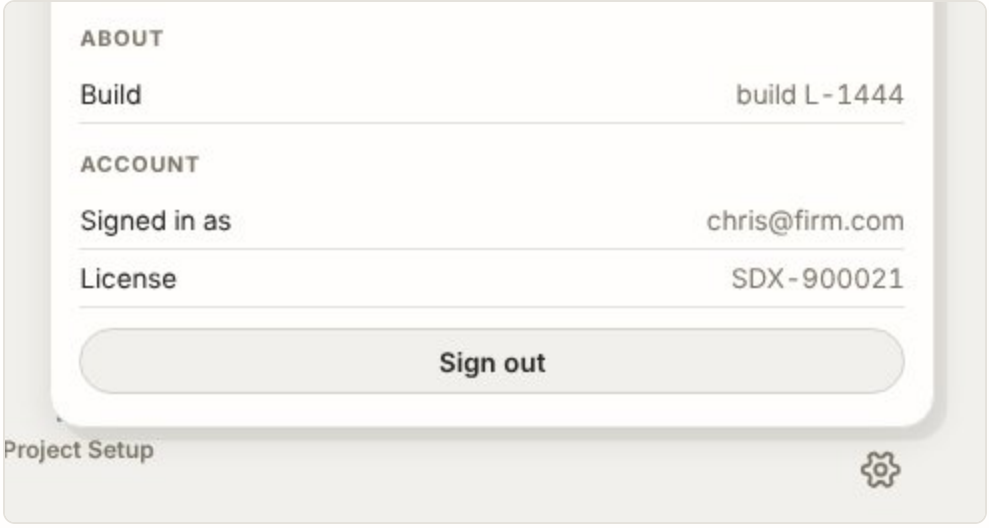
1. Go to sdxstorm.com and click **Sign in**.
2. Enter your email and password and click **Sign in**.
3. The first time you sign in on a browser, SDX emails you a 6-digit code. Enter it and click **Sign in**. That browser does not ask again for 90 days. The browser you activated on is already trusted.

You stay signed in on that browser for 30 days, including when SDX is updated. Each license works in one browser at a time: signing in somewhere else signs the first browser out.

Forgot your password: click **Forgot password?** on the sign-in page and enter your email. A link to set a new password is emailed to you. It works once, for one hour. Changing the password makes every browser ask for an emailed code again. After five wrong passwords, sign-in from your computer is paused for 15 minutes.

A renewed or new key: open **Activate your license**, enter your email, the new key and your current password.

Sign out: open **Settings** (the gear) on the home screen. The **Account** section shows the email and license you are signed in with. **Sign out** ends the session on that browser. If the project has unsaved changes, SDX asks first.



The Account section at the bottom of Settings.



Figure 1. The sign-in page.

No key yet

On the sign-in page, click `Start a free trial` or `Contact us`. A window opens on the same page. For a trial, enter your name, email and phone and your firm's name, address, phone and email, then click `Request trial`. The trial key is emailed to you, usually within one business day. The firm details you enter are printed on your reports.

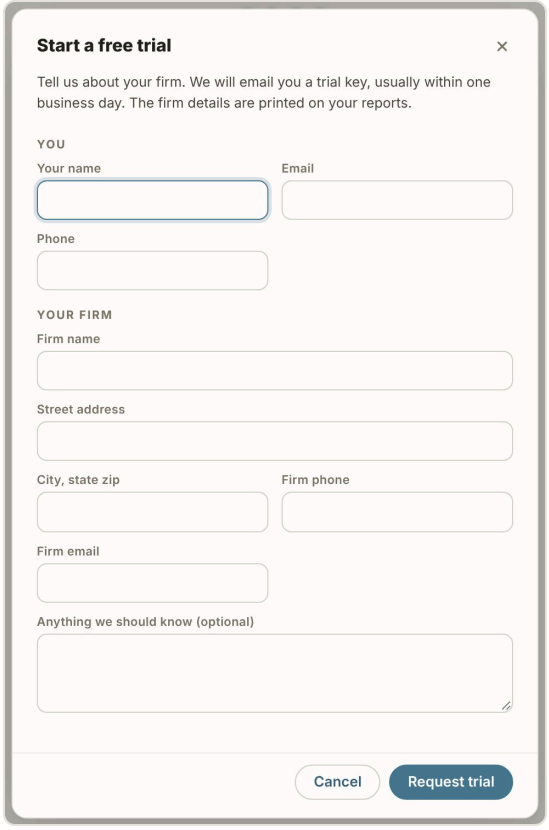


Figure 2. Start a free trial.

Each license key is for one user. Your firm's name and address come with the key: they are shown in Settings and printed on your reports, and they cannot be edited in SDX. To change them, use Contact us. Trial and education keys have full access to the calculations. Everything they print, including the site exhibits, the bound study and the WSPG listing, is marked on every page: TRIAL / NOT FOR SUBMITTAL, or EDUCATIONAL USE - NOT FOR SUBMITTAL. They cannot save CAD (DXF) or image (SVG) files, WSPG input decks, or HTML copies of reports. An education key ends on the last day of its semester. Reports printed with a licensed key are not marked.

The home screen

The home screen shows the five apps and the project buttons.

App	What it does
Hydrology	Rainfall, drainage areas, peak flows (Rational Method) and storm volumes, for each scenario.
Stormwater	Basin routing, outlets, drawdown, water quality volume and BMP sizing.
Storm Drain	Pipe networks: hydraulic grade line, profiles, cross sections, WSPG in and out.
Drainage Capacity	Catch basins, grate inlets, street sections and riprap outlet protection.
Tools	The CMP, drywell and PICP calculators, the O&M plan generator and the inlet bypass calculator.

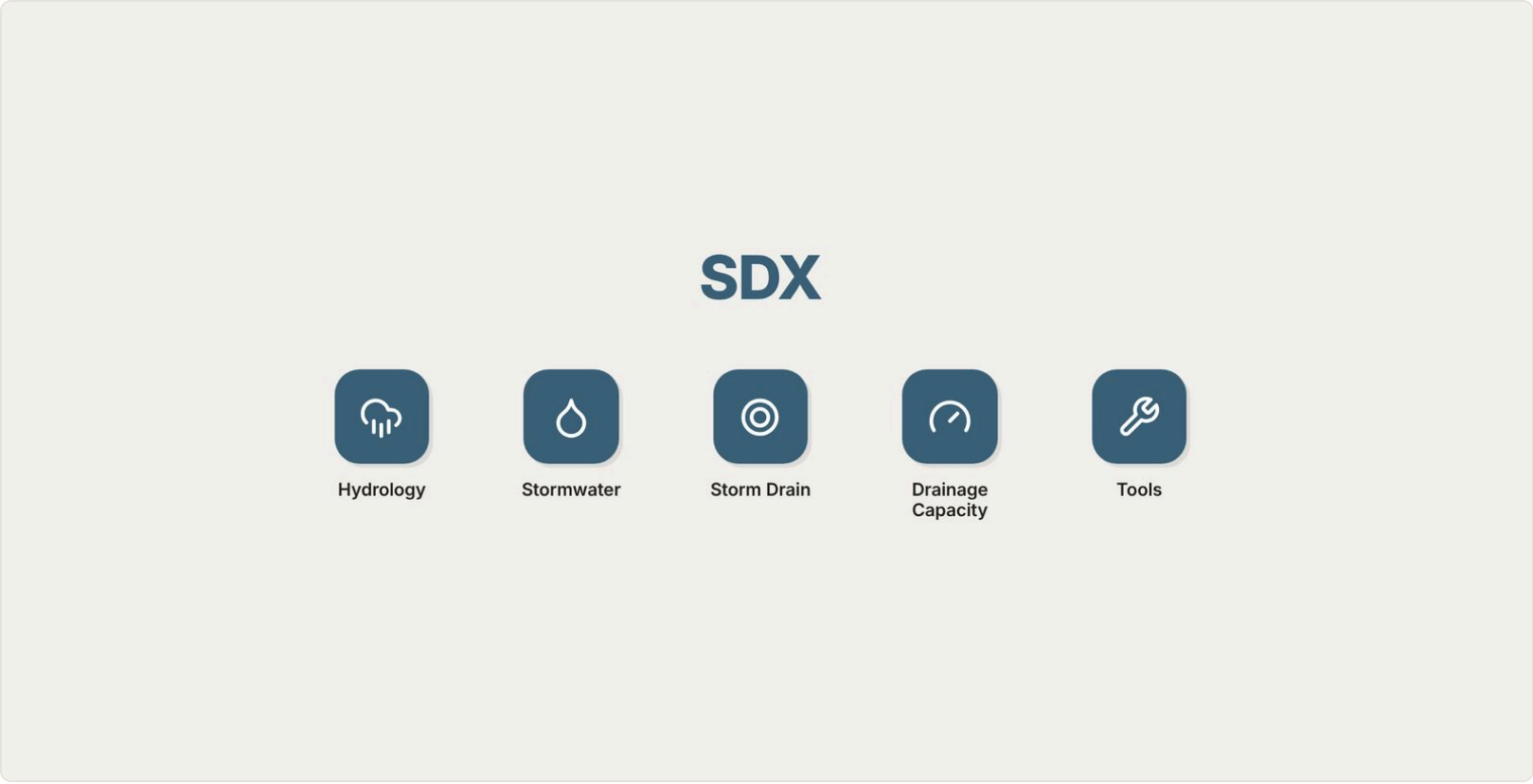


Figure 3. The home screen.

The buttons along the bottom are `New Project`, `Save Project`, `Load Project`, `Import PDF Plans` and `Project Setup`. Click the gear icon in the lower right corner to open `Settings`.

Moving between apps

Use the toolbar on the left side of the screen to switch between apps. Click the house icon to return to the home screen. Your inputs are kept when you switch apps.

On a tablet or phone, the toolbar is replaced by a small button at the bottom of the screen. Tap the button, then tap the app you want to open.

On a phone, the project buttons (New, Save, Load, Import PDF Plans and Project Setup) sit in a dock along the bottom of the home screen, and Settings is the gear at the top right.

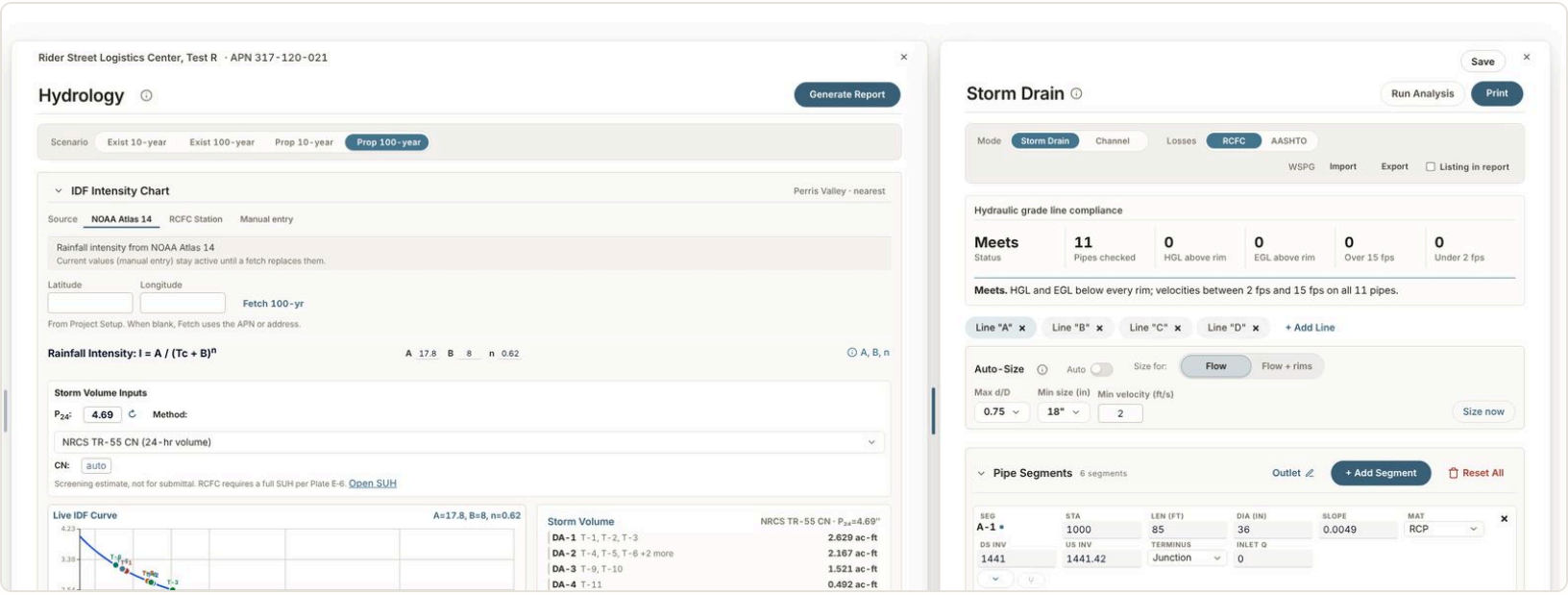
Split view

Split view shows two apps side by side, for example Hydrology and Storm Drain. It is available when the screen is wide enough for both.

- With a mouse, point to an app in the toolbar and click `Split right`. To return to one app, click `Close` on the right side.
- On a tablet in landscape, tap the button at the bottom of the screen, then press and hold an app until `Split` appears. Tap `Split`. To close it, press and hold the app again and tap `Close split`.

Resizing the two sides: drag the bar between the two apps to give one more room. Each app stops at the narrowest width its layout works at (Hydrology and Drainage Capacity stop sooner than the others). Double-click the bar to return to equal widths. With the bar selected, the arrow

keys move it in small steps, Home and End move it all the way, and Enter returns to equal widths. Split view opens at the widths you last used.



Split view with Hydrology wider. The bar between the apps is highlighted where the pointer rests on it.

Split view is not available on phones.

Light, dark or auto

To change the display, open Settings and select **Light**, **Dark** or **Auto** under Appearance. SDX opens in Light until you pick another. Dark keeps the same layout, blues and depth as Light on dark gray. Auto uses the light or dark setting of your computer. Printed reports are always light.

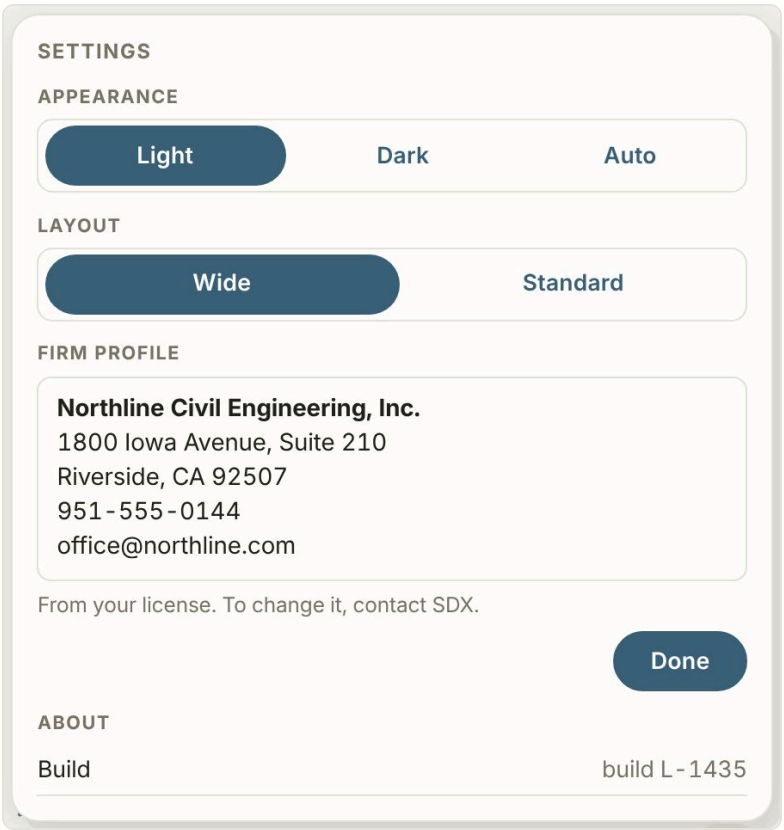


Figure 4. Settings: appearance, and the firm that comes with the license.

Wide layout

On a large monitor SDX uses the whole screen. Each app is laid out in columns: what you enter on the left, in the order you work, and the results it produces on the right, in the same row. Storm Drain shows the lines, Auto-Size and the compliance check beside the pipe segments and the profile. Hydrology puts each input next to the result it feeds, so the tributary areas sit level with the project summary. Stormwater lists its calculators down the left. Drainage Capacity puts the catch basin inputs across the top with the results below.

The wide layout turns on by itself when the window is wide enough, maximized or not, and turns off when the window is made narrower. Text and buttons are sized for the screen, so a 4K monitor shows SDX at a comfortable size. Split view, phones and tablets use the standard layout. Printed reports are the same in both layouts. To always use the standard layout, open `Settings` and select **Standard** under Layout.

In every layout, a long table or list shows about 12 rows (three segments when the pipe table is folded on a narrow screen) and scrolls inside its own card, with its headings kept at the top, so the page does not run on: the pipe segments, the Auto-Size results, the tributary areas, the critical storm table, the project hydrology summary, the compliance findings, the list of all catch basins, and any other table that grows past about 12 rows.

Pop-up windows fit the screen they open on, from a phone to a 4K monitor. A window taller than the screen scrolls inside itself and keeps its buttons in view at the bottom, and the page behind it stays still.

An open dropdown list stays with its dropdown when you scroll the page, and closes once the dropdown scrolls off the screen. Press Esc to close it.

> **Note:** Opening a project can take several seconds because SDX recalculates the project as it loads. A progress window is shown while this happens.

2 Starting, saving and importing projects

Projects are saved as files on your computer. Project data is not stored on the SDX server.

- `Save Project` saves all project data, including Project Setup, hydrology, basins, storm drains, capacity checks, label positions and attached maps.
- **Save in every app:** the top right of each app (the right side in split view) shows `Save` and whether the project is saved (`Unsaved changes` or `Saved`). Once the project has a file, `Save as` appears beside it. `Save` writes back to the file you opened or last saved, without asking where; the first time, Chrome or Edge asks once to allow SDX to edit that file. `Save as` saves to a new name or folder, and later saves go there. Ctrl+S (Cmd+S on a Mac) saves; Ctrl+Shift+S saves as. Safari and Firefox cannot write back to a file, so there each save downloads a new copy.
- **Undo and redo:** Ctrl+Z (Cmd+Z on a Mac) undoes the last change to the project, in any app: a typed value, a choice, an added or deleted row, a moved profile label. Ctrl+Y or Ctrl+Shift+Z redoes it. While you are still typing in a box, Ctrl+Z undoes the typing first, the way it does anywhere. SDX keeps the last 60 changes; opening a project starts the list over.
- `Load Project` opens a saved project and recalculates it. A file that is not an SDX project is refused and the open project stays open. If a file has values that would give wrong results (a blank rainfall n, a negative area, a line joined to a line that is not in the file), SDX lists them when it opens.
- `New Project` starts a blank project. Save your current project first.
- **Autosave:** SDX keeps a copy of the open project in this browser a moment after each change, and every 15 seconds. If the browser crashes or the page reloads before you save, the copy is listed under `Unsaved work` on the home screen the next time SDX opens. Nothing pops up and nothing has to be answered. `Restore` opens a copy on the tab you last had open, and saving it removes it from the list. `Dismiss all` clears every copy; copies you ignore are removed after 14 days. The copy stays in this browser on this computer for 14 days and is not a project file, so still use `Save`. Leaving with unsaved changes still asks first.
- **Field help:** Hover over a field name, or click it, to see what the field means. Click again or press Esc to close it.
- **Field limits:** Many fields have a sensible range (clogging 0 to 90%, runoff C 0 to 1). A value outside it is put back to the last good value, with a note giving the range. In metric, only negative values are refused.
- **Updates:** SDX is updated on the server. If an update goes out while you have SDX open, a bar at the top says so. Save your work and click `Reload` to get the new version; it asks first if you have unsaved changes. `Later` hides the bar. SDX never reloads on its own.
- **Lost connection:** if SDX cannot reach its calculation server, a red bar across the top of the page says so. The numbers on screen may be out of date while it shows. When the connection returns the bar clears and SDX recalculates the project. If the bar says you are signed out, sign in again in another tab and come back.

- Import PDF Plans reads storm drain lines from a plan PDF. Every PDF goes through the same reader, whether its labels are text, SHX linework, or a mix. SDX reads each line from its profile: the station labels along the bottom of the profile (10+00, 10+50) and the title just above or below them (LINE A, LINE 100, SD LINE 1, LATERAL 2). From the callouts on the profile it reads every pipe end's station and invert, and the rims of manholes, catch basins and inlets. Callouts can stand up the sheet (STA 10+00.00 over INV 245.00 over RIM 255.10) or run along one row (STA 10+00.00 INV 245.00 RIM 255.10); IE, FL, I.E., TC, TG, FS and GRATE are read too, as are stations written with the line name (SD1A:0+33.22) and callouts that list every pipe in a structure (24"(W) INV OUT, 24"(E) INV IN). Where a profile's callouts have no station, SDX takes each structure's station from its label along the bottom of the profile. Sheets saved turned in the PDF are read upright. Each pipe's size comes from its construction note number, its design flow from the Q printed under its reach, and each lateral's connection from where it joins. Before anything goes into the project, the Review import window lists each line with its pipes, length, sizes, plan flows, what it connects to, and anything to check. Clear a line to leave it out, then click Import. A project drawn on several plan sets is imported one set at a time. When a project is already open, the review asks whether to add the plan set to it or start a new project. When adding, a line with the same name as an open line is joined to it if its stations continue that line, as when a later phase picks up where an earlier one ended. A pipe left long in the earlier plans is cut at the structure where the new plans start, at its own slope, and the review notes the cut so you can check that invert. The sets can be added in any order: a set that holds the start of a line is joined below it, a set that picks up across a manhole is joined across the structure, and labels in parentheses (another set's pipe, shown for reference) are read as existing pipes and give way to the set that builds them. Lateral names with letters (LINE 701-A) are read, and a short profile whose grid labels do not match its callouts takes its stations from the callouts. A line that does not continue the open line of its name comes in as its own line. Where a structure is drawn with an inlet face and an outlet face, SDX places one structure at its centre with the drop between the two inverts; no short pipe is made across it. A drop through a structure (crowns matched where the size changes) is accepted; SDX flags a junction only when the pipe coming in is lower than the pipe going out. When nothing can be read, SDX says why, for example that no profile titles or station labels were found. A pipe with a flow from the plans carries that flow as drawn; its Plan Q is shown in the segment details, and clearing it returns the pipe to SDX's own flows. A flow whose velocity does not fit its pipe is left out, and where two sheets show different flows for one reach the larger is used; both are listed in the review. Box culverts (RCB) are not read from plans yet; SDX says so when a plan set has them, and you enter those segments as RCB. Scanned sheets with no text or linework are read from the sheet images, which takes a few minutes. Check every imported value against the plans. WSPG decks are imported from the Storm Drain toolbar.

> **Note:** Store project files with the project records.

3 Project Setup and the auto-draft

SDX drafts the narrative sections of the report: the introduction, site description, existing, offsite and proposed conditions, methodology, purpose of study, and conclusion. The text is built from your entries in Project Setup and in the Generate Report window. Each entry is inserted into a sentence, so enter it the way it should read in the report.

To open Project Setup, click **Project Setup** on the home screen or click the project name at the top of any app.

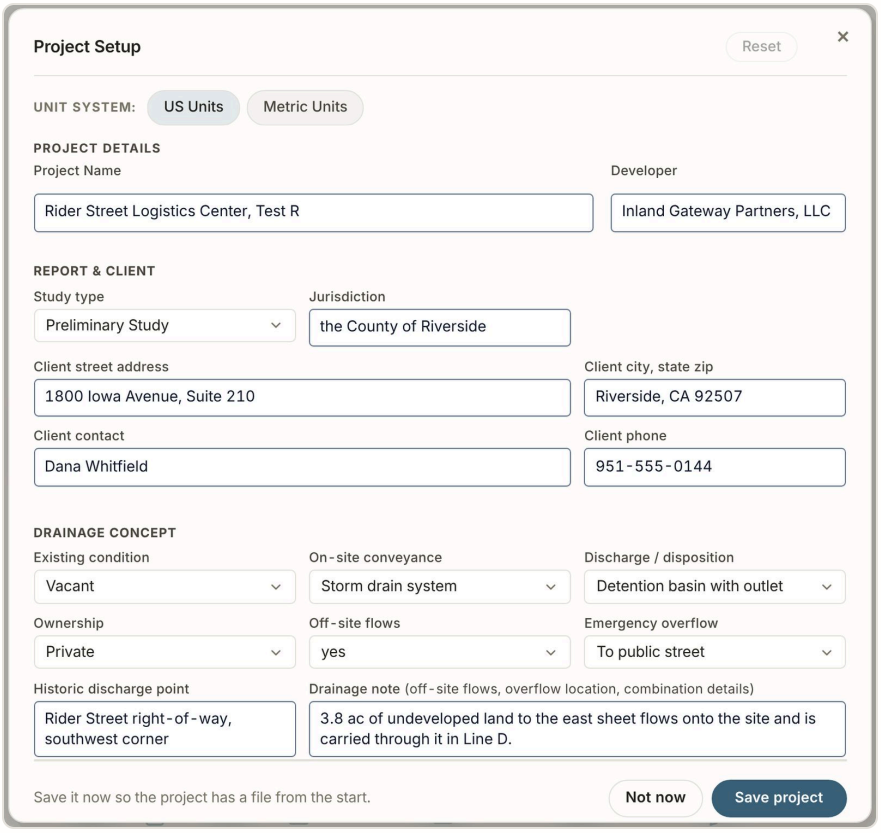


Figure 5. The Project Setup window.

On a project that has not been saved to a file yet, the bottom of Project Setup shows **Save project** and **Not now**. Save project closes setup and saves the project, so it has a file from the start. Once the project has a file, the button is **Done**.

> **General guidelines:** Do not include labels such as "Location:". Do not end entries with a period. Spell out abbreviations you would not use in a report.

All Project Setup fields

Field	What to enter
US Units / Metric Units	The units used throughout the project: every field, result, table, chart, profile and report. In metric, choose m³/s or L/s for flow. Pipe sizes are metric sizes (300, 375, 450 mm and up), stations read km+m (0+150.00) and profile scales are 1:N. SDX calculates in US units underneath, so switching back and forth never changes a result, and the setting is saved with the project. The WSPG listing and input deck stay in US units, as WSPG reads them.
Project Name	The project name as it should appear in the report.
Developer	The developer or owner, printed on the cover.
Study type	Preliminary or Final.
Jurisdiction	The agency, written with “the” (see below).
Client street address, city, contact, phone	The client information printed on the cover.
Existing condition, On-site conveyance, Discharge / disposition, Ownership, Off-site flows, Emergency overflow	Drop-down selections that set the drainage concept and the narrative (see below).
Historic discharge point	Where the site drains today (see below).
Drainage note	Additional detail about off-site flows, the overflow, or a combination system (see below).
Site Address	The APN, street and city of the site. In Riverside County a nine-digit APN is written with dashes for you (167-150-012).
Site Coordinates	Latitude and longitude. Click Detect to look them up from the APN, or from the address if there is no APN.
Design Agency	The criteria the study follows, for example Riverside County FCD & WCD. It is set to the county whose method the project uses, it can be changed, and it is saved with the project. The report prints it as the agency.
Engineer Name, PE / RCE No.	The engineer of record, printed in the certification. Enter the name as it reads on the stamp (Jane Smith) and the license number alone (12345); SDX adds RCE or PE where it prints it.

Text fields used in the narrative

Field	Type it like this	Not like this	Where it lands
Project Name	Rider Street Logistics Center	~~Proj: Rider St~~	**Rider Street Logistics Center** (APN 317-120-021) is located at …
APN	317-120-021	~~APN# 317120021~~	… (APN **317-120-021**) is located …
Site Address (street)	2350 Rider Street	~~2350 Rider St, Perris CA 92570~~	… is located at **2350 Rider Street** in …
Site Address (city)	Perris	~~City of Perris~~	Used for "the City of Perris" when Jurisdiction is left empty.
Jurisdiction	the City of Banning the County of Riverside	~~Banning~~ ~~Riverside Co.~~	… is located at 2350 Rider Street in **the County of Riverside**. If the jurisdiction is an agency, such as a flood control district or public works, the sentence uses the city: "… in Perris, CA". With no city entered it reads "under the jurisdiction of" the agency.
Historic discharge point	the Rider Street right-of-way at the southwest corner	~~SW corner.~~	… drains as sheet flow … to the existing point of discharge at **the Rider Street right-of-way at the southwest corner**.
Hydrology map Generate Report window	attach the map before Auto-Draft		The draft says "shown on the hydrology map" only when a hydrology map is attached to the report.
Drainage note	a phrase, or one full sentence (see below)	~~See plans.~~	Joins the offsite or overflow sentence.
Infiltration source report Generate Report window	Preliminary Geotechnical Investigation (Inland Geotech, July 2026)	~~geo report~~	… (measured rates of 1.1, 1.4 in/hr per the **Preliminary Geotechnical Investigation (Inland Geotech, July 2026)**).
Measured infiltration Generate Report window	1.1, 1.4	~~1.1 in/hr and 1.4 in/hr~~	SDX adds the units: "measured rates of **1.1, 1.4** in/hr".
Design infiltration Generate Report window	0.5	~~0.5 in/hr~~	A design infiltration rate of **0.5** in/hr is used …

The drainage note

The note is added to the offsite flow sentence if offsite flows enter the site. Otherwise it is added to the emergency overflow sentence. The note can be entered in either of two forms:

- A short phrase, starting in lower case with no period. It is added after a comma:
  Off-site flows enter the site, `conveyed in a 24-inch pipe through the site to the basin`.
- A complete sentence, starting with a capital letter. It is added as a separate sentence:
  Off-site flows enter the site.
  `3.8 acres of undeveloped land to the east sheet flows onto the site and is carried through it in Line D`.

Drop-down selections

Each drop-down selection in Project Setup adds a fixed sentence or phrase to the narrative. The table below shows the text for each selection.

Question	Choice	What it writes
Existing condition	Vacant	The existing site is vacant … There are no existing drainage improvements on the site.
	Developed	The existing site is developed … Existing drainage improvements are to be removed with the proposed development.
	Partially developed	The existing site is partially developed …
On-site conveyance	Storm drain	On-site runoff is collected by the proposed on-site storm drain system and …
	Surface	… conveyed by surface flow in the proposed curb and gutter and …
	Swales	… conveyed by proposed swales and open channels and …
	Existing storm drain	… collected by the existing on-site storm drain system, which is to remain, and …
	Combination	… collected by a combination of surface conveyance and the proposed storm drain system and …
	None	… conveyed as sheet flow and …
Discharge / disposition	Retention	… directed to the proposed on-site retention basin for infiltration.
	Detention	… directed to the proposed detention basin and released through a controlled outlet.
	Drywells	… directed to proposed drywells for infiltration.
	Chambers	… directed to proposed underground storage chambers.
	LID	… infiltrated through proposed permeable pavement and LID facilities.
	Street	… discharged to the public street through parkway drains.
	Public storm drain	… discharged directly to the public storm drain system.
	Offsite	… discharged to the existing off-site drainage course.
	Combination	… managed by a combination of on-site facilities (your note).
Emergency overflow	None	No sentence.
	Street	Emergency overflow is provided to the public street.
	Public storm drain	Emergency overflow is provided to the public storm drain system.
	Offsite	Emergency overflow is provided to the off-site drainage course.
Off-site flows	Enter / do not enter	Off-site flows enter the site. / No off-site flows enter the site.

Land use comes from the tributary areas

The existing and proposed land uses in the narrative are taken from the development type of each tributary area in Hydrology (Chapter 4), listed from largest to smallest area. Land uses that make up less than 8% of the total area are not listed. The development type also sets the runoff coefficient, so select the type that matches the actual use.

Development type	Reads as
Single family, small / medium / large / estate	single family residential on lots under 1/4 acre (and so on by lot size)
Multi-family, apartments	multi-family residential, apartments
Commercial, light and heavy industrial	commercial, light industrial, heavy industrial
Pavement, park, natural, agricultural	paved areas, parks and landscaping, natural undeveloped land, agricultural land

Before and after

Project Name	**Rider Street Logistics Center**
APN	**317-120-021**
Street	**2350 Rider Street**
Jurisdiction	**the County of Riverside**
Existing condition	**Vacant**
Historic discharge	**the Rider Street right-of-way at the southwest corner**
Conveyance	**Storm drain system**
Disposition	**Detention basin with outlet**
Overflow	**To public street**

Rider Street Logistics Center (APN 317-120-021) is located at 2350 Rider Street in the County of Riverside. The site is approximately 22.60 acres.

The existing site is vacant, consisting of natural undeveloped land. Existing runoff drains as sheet flow across the site in the direction of the historic gradient to the existing point of discharge at the Rider Street right-of-way at the southwest corner. There are no existing drainage improvements on the site.

The proposed development consists of light industrial and paved areas with associated grading, paving and landscaping, and is approximately 78% impervious. On-site runoff is collected by the proposed on-site storm drain system and directed to the proposed detention basin and released through a controlled outlet. Emergency overflow is provided to the public street.

Left: Project Setup entries. Right: the resulting narrative. Highlighted text comes from Project Setup. The acreage and percent impervious come from the hydrology.

Blank fields: If a field is left empty, the narrative shows _____ in its place and the Report Readiness panel lists it under Narrative blanks. Complete the field or edit the paragraph before printing.

The drafted paragraphs can be edited in the report builder. Redrafting replaces all paragraphs, including any edits, so complete Project Setup before editing the text by hand. SDX asks for confirmation before replacing edited text.

4 Hydrology

The Hydrology app calculates peak flows by the Rational Method and storm runoff volumes for the existing and proposed conditions.

Scenarios

Use the scenario bar at the top to switch between Exist 10-year, Exist 100-year, Prop 10-year and Prop 100-year. Each scenario has its own tributary area table. Rainfall is shared between the existing and proposed scenarios for the same storm.

Rainfall

- **NOAA Atlas 14:** Downloads the rainfall depths for the site coordinates and fits the intensity equation $I = A / (Tc + B)^n$. The coordinates are taken from the APN lookup in Project Setup. If the coordinates are blank, the Fetch button finds them from the APN or address first. If NOAA cannot be reached, nothing is changed and SDX says so; try again in a minute or use a station.
- **RCFC Station:** Select the nearest District rain gauge station, then click `2-yr`, `10-yr` or `100-yr` to apply its coefficients. The station is saved with the project, and the report names it as the rainfall source.
- **Manual entry:** Enter A, B and n directly.

The IDF chart plots each tributary area at its time of concentration.

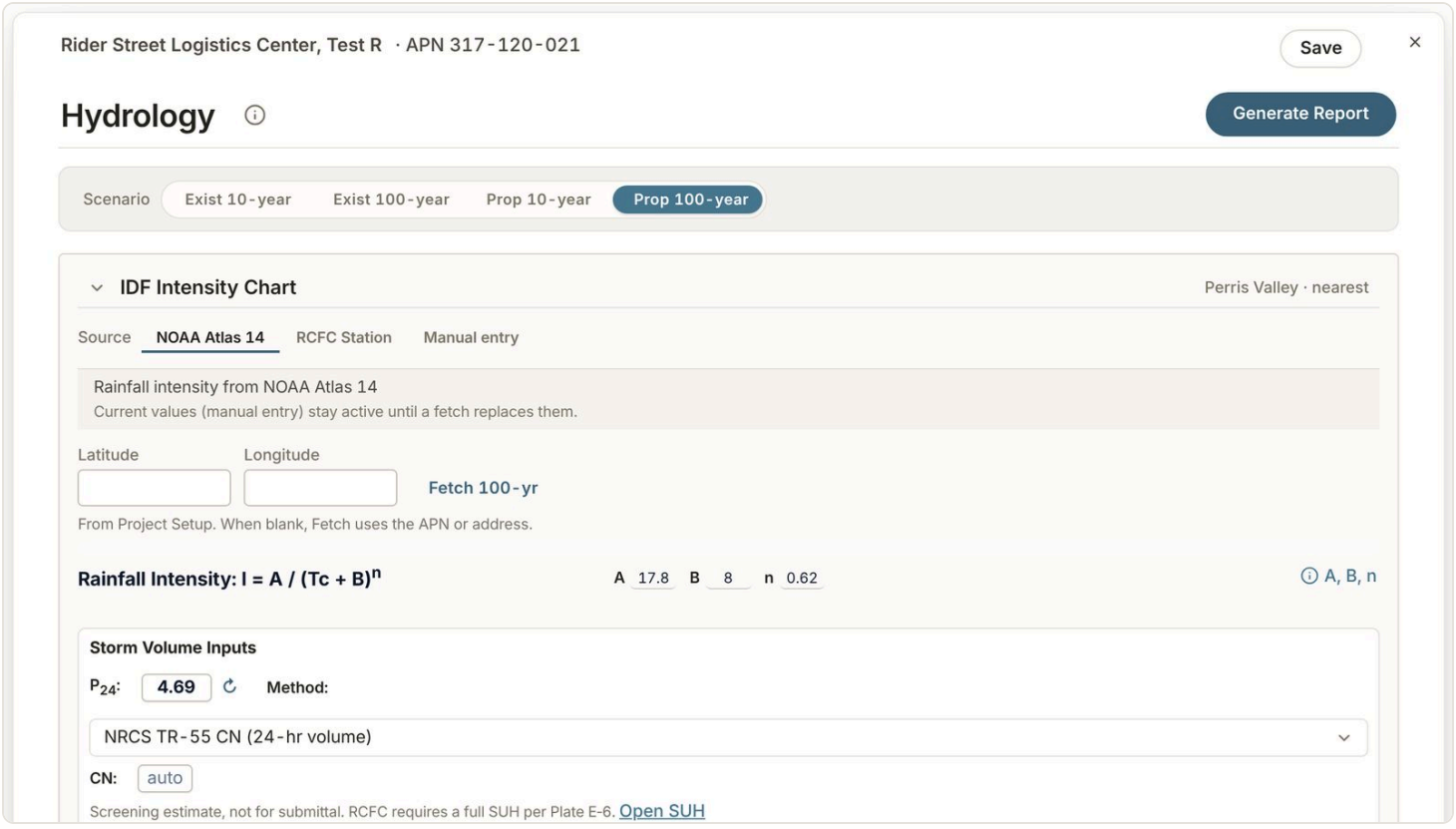


Figure 6. Hydrology: scenarios and the IDF intensity chart.

Which county method SDX uses

Question 1 of the Setup in the Generate Report window sets the county method. The county saves with the project file, so the project opens with the same method on any computer. Files saved before this change open as Riverside.

- **Riverside County:** the RCFC Hydrology Manual.
- **San Bernardino County:** Chapter 4 of the San Bernardino County Hydrology Manual, 2026 Edition. Peak flows are Q = 0.90 (I − Fm) A. A San Bernardino box appears above the A, B and n fields: enter the one-hour rainfall for each storm (or click `Use NOAA 1-hour depth`), leave the slope at 0.5, and pick the site's moisture condition from the manual's Figure 3-2 map (AMC III for the valley and mountains, AMC I for most of the desert). The tributary table shows Fm in place of C.
- **Orange County:** Section D of the Orange County Hydrology Manual (1986). Peak flows are Q = 0.90 (I − Fm) A, with loss rates from Table C.2 (soil A 0.40, B 0.30, C 0.25, D 0.20 in/hr). Intensities come from the Figure B-3 curves for areas below about 2,000 ft, so there is nothing to enter; A, B and n are not used. The tributary table shows Fm in place of C. Mountain areas (Figure B-4) are not covered.
- **San Diego County:** Section 3 of the San Diego County Hydrology Manual (2026). Fetch NOAA Atlas 14 for the site; intensities are read between its 5, 10, 15, 30 and 60-minute values as the manual requires. C comes from the impervious percentage and soil group (Table 3-1). The first subarea's time uses Table 3-2 and the Figure 3-1 overland equation, with Kirpich time for any length past the table's maximum. Junctions use the Section 3.4.2 junction equation.
- **Los Angeles County:** Section 12.2 of the Los Angeles County Hydrology Manual (2006), the rational method for small watersheds. In the Los Angeles box on the Hydrology tab, enter the 50-year, 24-hour depth from the Appendix B isohyetal map and the predominant soil type number (2 to 180). Each subarea gets its own time of concentration by the manual's Equation 7.3.5, using its flow path length and slope, and its own C from the Appendix C soil curve. Subarea peaks add together downstream. The manual's hydrograph method (MODRAT) is not built, so use this for small sites only.
- **Other location:** NOAA Atlas 14 rainfall with Riverside County runoff factors and times as general values. The report says so and that they have not been checked against the local manual.

For every county except Riverside, storm volumes use the NRCS curve number method, and the report says so.

Tributary areas

Each row in the table is a tributary area within a drainage area (DA). Enter rows in downstream order within each DA.

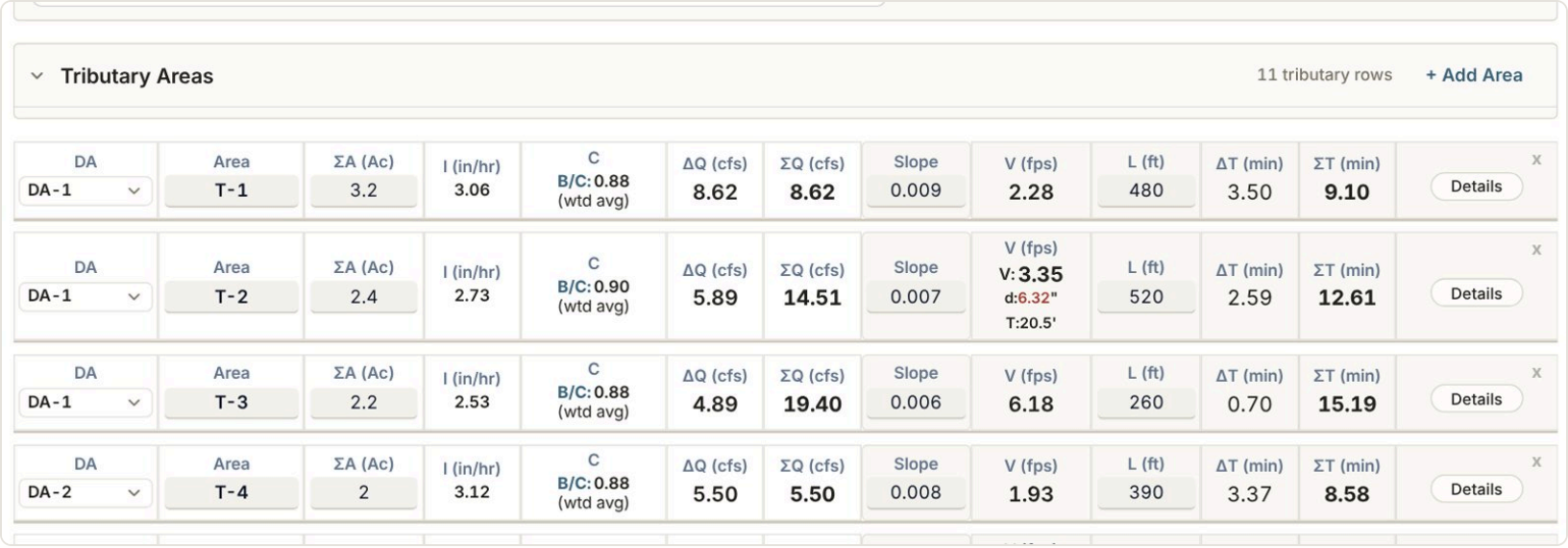


Figure 7. The tributary area table.

Row type	Use it for	You enter
Initial area	The top of a flow path	Area by soil group, development type, and under **Initial area** in Details the flow length L and fall H (the nomograph gives the initial Tc)
Subarea	Area added as flow travels on	Area, development type, and the travel reach: street, private drive or pipe size, its length and slope
Confluence	Where two branches meet inside a DA	The last row of each branch. Flows are combined per Plate D-1, tried at each branch's Tc; the larger total governs. A confluence row adds no area and no storm volume; its volume column shows a dash

For each row SDX calculates the rainfall intensity, incremental and cumulative flow, velocity and travel time. The peak flow at the DA outlet is the flow at the end of the last branch, combined with any other branches per Plate D-1.

Where pipes join, each flow keeps its own Tc down the line (plus travel time), and SDX tries every one. The node note lists each flow and its Tc at that node, so the total can be checked by hand. When a DA's initial Tc is filled from sheet flow, SDX uses TR-55 for the first 100 ft with the 2-year 24-hour rain from the NOAA data, then shallow flow. Without NOAA data it uses Kerby.

The first row of a drainage area comes in marked **Initial area**. Its L and Slope in the table are the travel reach from that row to the next one, not its own flow path. A row added after the first comes in with no DA (a dash); pick its DA in the DA column, or it is left out of the totals.

> **Two branches in one DA:** Start the second branch with a new initial area. Then add a confluence row and select the last row of each branch.

Tributary area table

Column	Meaning
DA	The drainage area the row belongs to.
Area	The row's own area in acres, the total of its soil areas.
ΣA	The cumulative area at the row (calculated).
I	Rainfall intensity at the row's time of concentration (calculated).
C	Runoff coefficient from the soil groups and development type (calculated).
ΔQ, ΣQ	The row's own flow and the cumulative flow at the row (calculated).
Slope	The slope of the travel reach, ft/ft.
V	Velocity in the travel reach (calculated).
L	Length of the travel reach, ft.
ΔT, ΣT	Travel time in the reach, and the time of concentration at the row (calculated).

Row details

Click Details on a row to enter the following:

Field	What to enter
Soil areas	The area in each hydrologic soil group (A, B, C, D), in acres.
Development type	The land use. Sets the runoff coefficient and the land use described in the narrative. In Riverside, C = 0.90 [Ai + (1 − Ai) I / (I + S / 7.5)], S = 1000 / RI − 10, the Plate D-5.7 curves, so C changes with each row's rainfall intensity. Ai is the impervious fraction (Plate D-5.6) and RI the runoff index of the pervious cover (Plate D-5.5). This matches CivilDESIGN.
Tc mode	**Initial area** (ticked on the first row of a DA): enter the flow path length L and fall H for the initial time of concentration. **Nomograph** uses Plate D-3 in the closed form CivilDESIGN and AES use, $Tc = K\,(L^3 / H)^{0.2}$, with the cover K following the development type until you pick one (K 0.940 undeveloped good cover, 0.706 fair, 0.530 poor, 0.390 single family 1/4 acre, 0.356 condominiums, 0.323 apartments, 0.300 commercial). **Confluence** combines the rows you pick. **Offsite** marks run-on from outside the site.
Section type	The travel reach for a subarea: street (by width), private drive, alley, or pipe (by diameter).
Curb type	The curb for a street reach. Used for gutter flow depth and spread.
Confluence	Marks the row as a confluence and selects the rows that combine there.

Other inputs

Field	What to enter
Latitude, Longitude	The site location for the NOAA download. Taken from Project Setup, and can be changed here.
A, B, n	The IDF coefficients. Filled in from NOAA or a station, or entered by hand.
P_{24} and the method	The 24-hour rainfall depth and the runoff volume method (NRCS curve number or RCFC volumetric).
CN	The curve number. Leave it on auto to use the soils and land use.
P_{1hr}, P_{3hr}, P_{6hr}, P_{24hr}	Rainfall depths for the critical storm analysis. Click ↻ Auto to calculate them from the IDF coefficients, or Published depths to look them up.

HCOC assessment

Click HCOC Assessment, Form 4.2-3 to complete the WQMP form comparing existing and proposed runoff volumes. Click + column to add a drainage area and Print Form 4.2-3 to print it.

Storm volume and the unit hydrograph

Storm volume is calculated from the 24-hour rainfall depth using the NRCS curve number method or the RCFC volumetric method. Each tributary area is counted once. The Project Hydrology Summary lists the project peak with every DA outlet's Tc tried as the time of the peak; the largest total governs and is the figure on the Project Summary page. The synthetic unit hydrograph (Section 5 of the report) provides the inflow hydrograph used for basin routing in Stormwater. SDX uses the full synthetic unit hydrograph method with routing, not the short-cut method. The 1-hour storm runs on the RCFC method too, with the District's HEC-HMS Preprocessor pattern for the slope of the intensity-duration curve (**1-hr slope**, Plate D-4.6; blank takes it from the IDF curve between 10 and 60 minutes). CivilDESIGN's 1-hour pattern puts slightly more rain in the peak 5 minutes, so its 1-hour peaks run 1 to 4 percent higher at the same volume. On Riverside projects you can type the loss rate F and the low loss rate (the share of light rain that soaks in). Left blank, both come from the soils and the Imp % box, or from the tributary land use if you have not changed Imp %; the low loss rate is then 0.9 − 0.8 Ai, as CivilDESIGN. **Low loss rule** sets where the low loss rate applies. **Smaller loss** (the default) loses the smaller of F and the low loss rate times the rain in each period; this matches CivilDESIGN 7.1 and later. **Hydrology Manual** follows the Manual's wording: F whenever the rain is heavier than F, otherwise the low loss rate; this matches CivilDESIGN 7.0. Otherwise the two give the same result. **S-graph** Mix takes a combination of S-graphs in percent (valley / foothill / mountain / desert, e.g. 0/65/35/0), as CivilDESIGN's Combination of S Curves. If a first area is over 10 acres or 1,000 ft long, the tributary table says so; RCFC Plate D-3 does not cover it, so split it. Rain is reduced for large drainage areas per Plate E-5.8, and on Riverside projects the basin is sized on these unit hydrograph volumes. Both show in Section 5 of the report. The unit hydrograph and the calculator panels stay open in a saved project and open again when you load it. In the basin volume check under the unit hydrograph, a

Percolation rate (in/hr) lets water soak through the basin floor while the storm fills it, so the basin needs to hold less. SDX shows which storm fills it most and how long it takes to empty.

In Riverside the unit hydrograph follows RCFC Section E for the 3, 6 and 24-hour storms. Pick the S-graph that fits the watershed: Valley (valley floors), Foothill (small steep areas), Mountain or Desert. The loss rate F is worked out from the tributary areas; type a value to override it. Method switches to NRCS Type II if the agency asks for it. Other counties use NRCS. If the lag time works out too short or too long to be real (a typo in the length, slope or n), the results box says so instead of showing results.

Basin routing then routes the 3, 6 and 24-hour storms and keeps the one with the highest water surface. The report names it and lists each storm's water surface.

Generate Report

Click `Generate Report` at the top right to create the hydrology study. See Chapter 8.

5 Stormwater

The Stormwater app is used to size storage facilities. It includes basin routing, outlet sizing, drawdown time and water quality volume.

Basin routing

1. Select the drainage areas tributary to the basin. Their total runoff volume is the required storage. The Section 5 hydrograph is used as the inflow.
2. Enter the basin bottom and top elevations and the bottom and top areas. For a basin that is not one even slope from bottom to top (a bench, a low-flow channel, an odd shape), use **Contours** instead: type or paste the area at each contour, or click **Read from PDF** to take them from the grading plan.
3. Select the outlet type (none for a retention basin, orifice, weir or pipe) and enter the emergency spillway.
4. Review the routing results: peak inflow, peak outflow, maximum water surface elevation, storage used and freeboard.

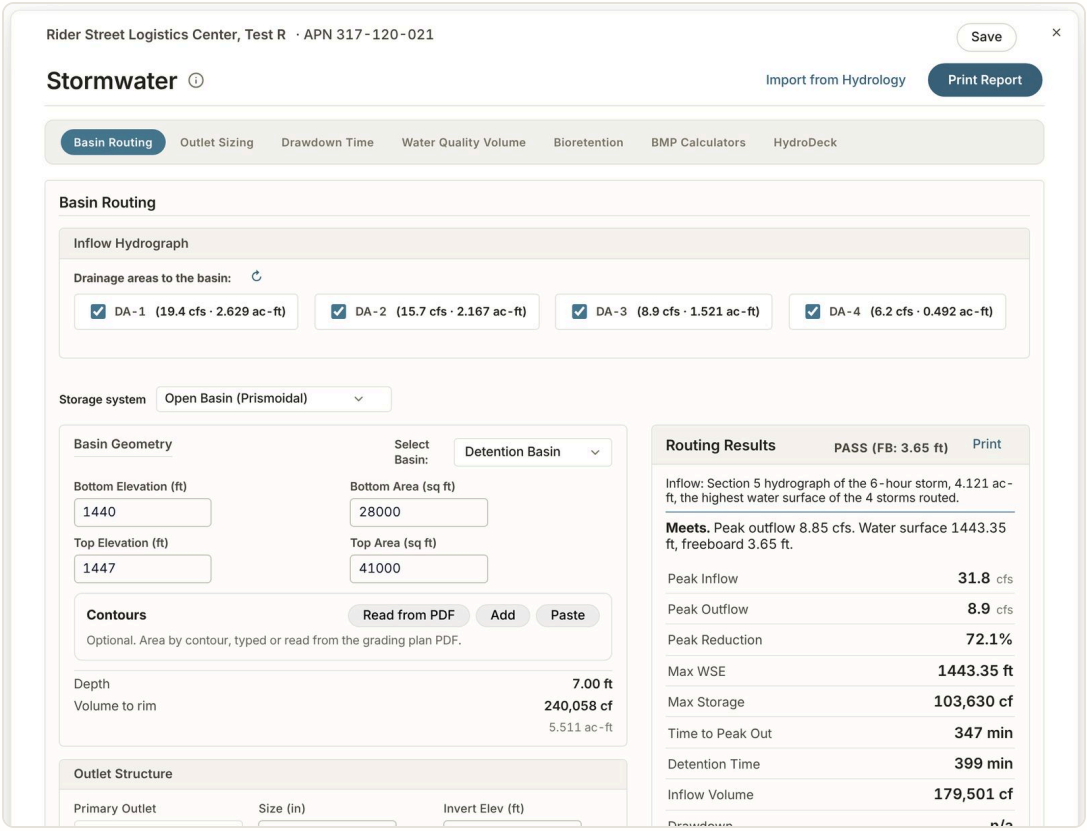


Figure 8. Stormwater: basin routing.

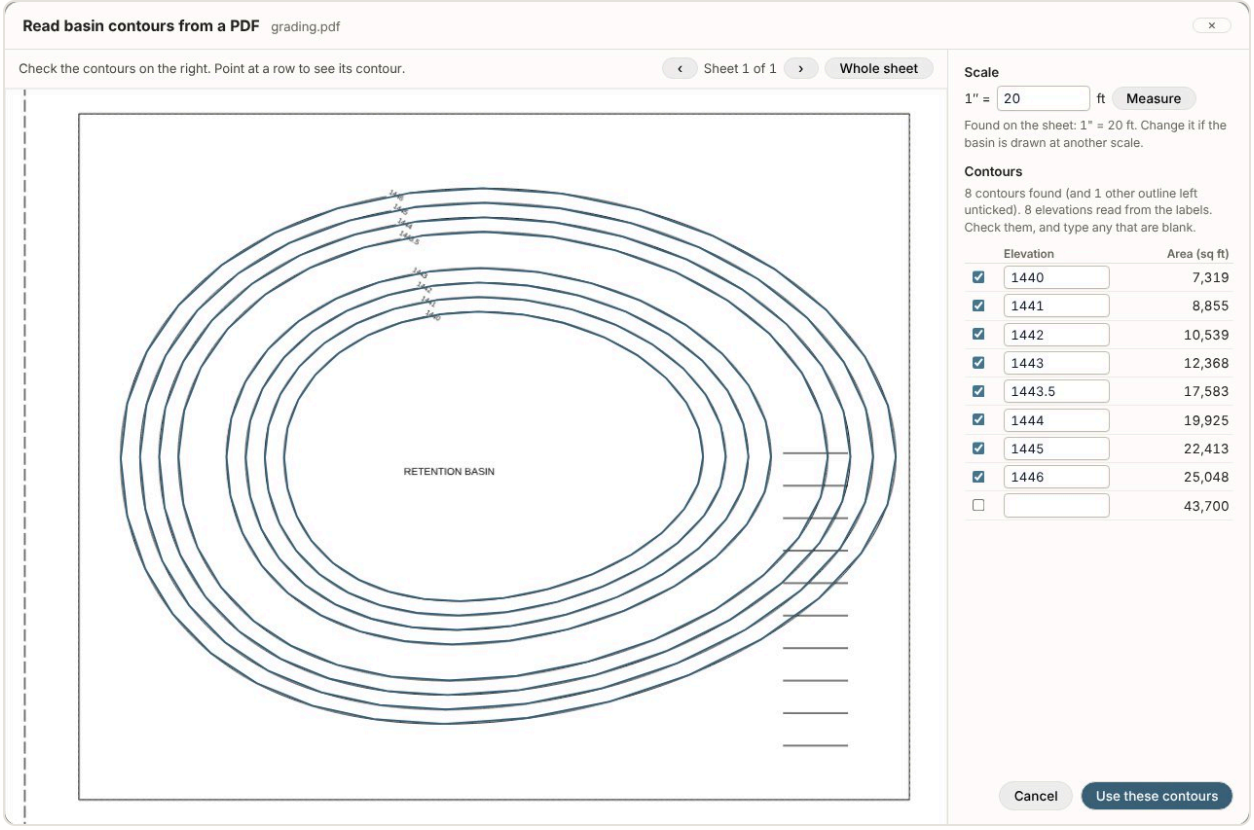


Figure 9. Reading basin contours from a grading plan PDF.

SDX checks for 1.0 ft of freeboard on a basin with an outlet and 0.5 ft on a retention basin with no outlet. It also compares the peak outflow to the existing condition peak flow. If the water rises above the top of the stage table, the results say the basin overtops.

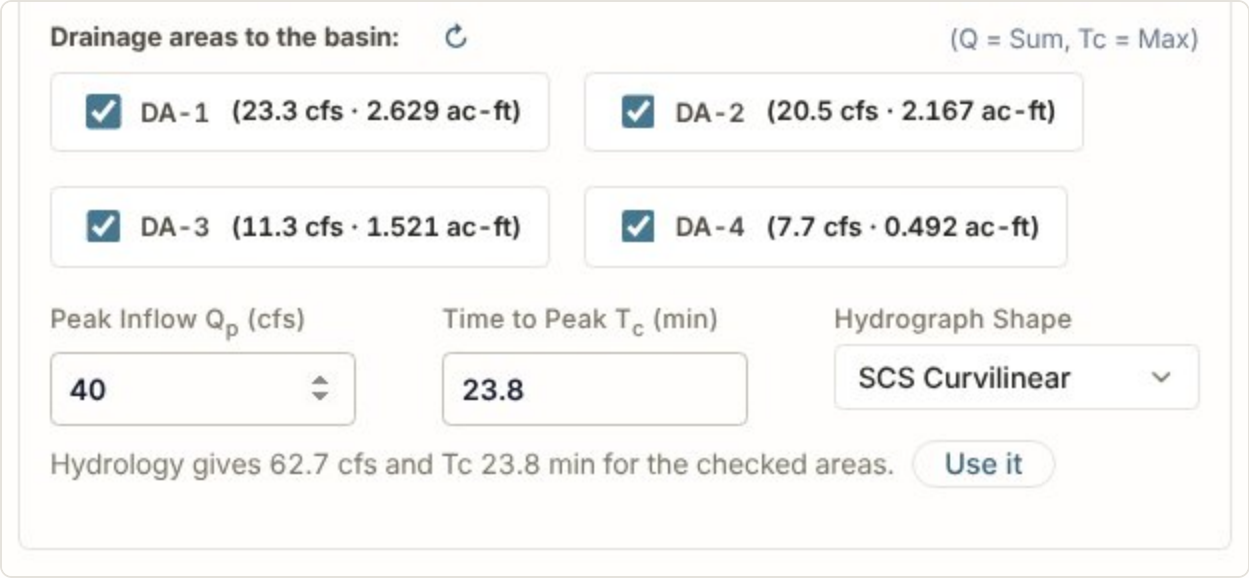
Stormwater, Storm Drain and Drainage Capacity use proposed flows. Opening one of them while Hydrology shows an existing scenario switches Hydrology to the proposed scenario of the same storm, and a note says so. The first time a basin is routed it becomes a basin the storm drain can discharge into.

Click **Import from Hydrology** to bring in flows and times of concentration. Click **Print Report** to print the sheet for the tab that is open: the routing results on Basin Routing, the open calculator's sheet on BMP Calculators, and a sizing sheet on each of the others.

Basin routing fields

Field	What to enter
Drainage areas to the basin	Check each drainage area tributary to the basin.
Peak Inflow Qp, Time to Peak Tc	The inflow peak and time to peak, filled in from the checked drainage areas. They follow the hydrology until you type your own values, which are then kept and saved with the project. A value saved in a project is kept when it is opened. When the hydrology gives something else, a note under the fields shows its values; click **Use it** to fill them in and follow the hydrology again. Checking or unchecking a drainage area does the same. When the project has a Section 5 hydrograph, the basin routes that hydrograph and these fields are hidden.
Hydrograph Shape	The inflow hydrograph shape, for example SCS curvilinear.
Additional inflow sources	Other inflows to the basin, entered by hand or taken from a storm drain line.
Storage system	Open basin (prismoidal) or another storage type.
Bottom and top elevation, bottom and top area	The basin geometry. When the contour table has two or more contours, these four follow it and cannot be typed.
Contours	Optional. The area at each contour, lowest first. Storage is built contour by contour with the frustum formula between each pair, so a bench or a change of slope is counted. **Add** adds a row, **Paste** takes two columns (elevation, area) copied from a spreadsheet or the CAD area list, and **Clear** goes back to bottom and top only. The column on the right is the storage up to each contour. Once the basin has been routed, any change to its geometry routes it again, so the results always match the basin on screen.
Read from PDF	The first time, a short note lists the PDF requirements; tick Don't show again to skip it, and PDF requirements in the reader shows it again. Opens a vector PDF of the grading plan (printed from CAD, not a scan; a scanned sheet is recognized as soon as it opens). If a step fails, the reader says which one and what to do, for example no closed contours in the box, no elevation labels read, or no scale. Drag a box around the whole basin, rim included. SDX finds the closed contours inside the box, joins lines broken by their labels, and reads each contour's elevation from its label. Check the scale (taken from the sheet's scale note when it has one; **Measure** sets it from two points a known distance apart) and the elevations: a blank elevation is outlined in red, one filled in at the contour interval in amber. An outline outside the labeled contours, such as a curb, is left unticked. **Use these contours** fills the contour table, and the basin schematic and its printed section are drawn from the plan's outlines. A contour you add or change later keeps a plan shape: between two plan contours it is blended from both, outside them it copies the nearest, and either way it is scaled to its own area. A table that never came from a PDF draws each contour as a rectangle of its area.
Outlet type, Size, Invert Elev	The outlet (orifice, weir or none), its size in inches and its invert elevation, which must be in the basin (from the bottom up to below the top).
Spillway Width, Spillway Crest	The emergency spillway. The crest must be above the basin bottom and no higher than the top.

Field	What to enter
Connection	A pipe or channel connecting this basin to another basin downstream.



A Peak Inflow typed by the user is kept. The note under it gives what the checked drainage areas add up to.

Multi-storm analysis

Enter the Drainage Area, Runoff Coef. (C), Time of Concentration and Allowable Release, or click `Import Area, C, Tc from Hydrology`. Click `Run All 4 Critical Storms` to route the 2, 10, 25 and 100-year storms and find the one that governs. Each storm uses the project's own rainfall for it: the developed scenario of that storm, the RCFC station the project uses, or the NOAA Atlas 14 table. A storm the project has no rainfall for is not run, and the results say which (RCFC stations publish the 2, 10 and 100-year only).

The other tabs

Tab	What it checks
Outlet Sizing	Sizes or checks a circular or rectangular orifice, a sharp or broad-crested weir, or a V-notch weir. Pick the Outlet Type and the Mode. Size for Target Q: enter the Target Flow and the Head, and SDX gives the orifice diameter, the rectangular orifice width for the height you enter, the weir length, or the notch angle. Calculate Q for Size: enter the Head and the size, and SDX gives the flow. Head is to the orifice centroid, or over the weir crest. Only the boxes the type needs are shown.
Drawdown Time	Enter the Storage Volume, Bottom Area and Infiltration Rate, select the maximum drawdown time, and click Calculate Drawdown.
Water Quality Volume	Enter the Tributary Area and Runoff Coefficient and select the 85th percentile storm depth. Click Calculate WQV. Import from Hydrology fills the area from the developed tributary areas and C from their imperviousness, $C = 0.858i^3 - 0.78i^2 + 0.774i + 0.04$. On the Drawdown Time and Bioretention tabs, Use WQV brings the volume in.
Bioretention	Enter the Design Volume, media porosity, gravel storage depth and void ratio, the underdrain, and the native soil infiltration rate. Click Calculate Bioretention. With no Design Volume the results stay blank.
BMP Calculators	Select a calculator (CMP retention, drywell or PICP) and a drainage area, then click Send Inflow. The calculator opens with the peak flow and Tc filled in.
HydroDeck	Sizes a HydroDeck underground storage system. Enter the tributary impervious area, runoff coefficient, storm depths, infiltration rate and maximum drawdown, then click Calculate HydroDeck. Storm Runoff is the governing storm's runoff; part of it soaks in during the storm, so the deck stores less. A cross-section and a cutaway show the deck at the chosen depth, with a legend for each layer.

6 Storm Drain

The Storm Drain app calculates the hydraulic and energy grade lines for each storm drain line using the methods of the RCFC Hydraulic Design Manual. Results can be exported to WSPG for comparison.

Lines and segments

1. Click `+ Add Line` to add each line (Line "A", Line "B" and so on). Lines can be reordered by dragging.
2. Set the outlet condition under `Outlet`: free outfall, starting HGL, basin, or junction with another line. For a basin outlet, the routed water surface is used as the tailwater.
3. Add pipe segments starting at the outlet and working upstream. Enter the station, length, diameter, slope, material, downstream and upstream inverts, and the structure at the upstream end.
4. For each inlet, use `Assign DA` to take the peak flow from Hydrology. This keeps the storm drain flows consistent with the hydrology.
5. Click `Run Analysis`. If a segment has a blank length, size, n or invert, SDX names it and asks you to fill it in before using the results.

The HGL at each structure is the water surface at the top of the pipe below it plus the structure's loss. Size changes are judged in the direction of flow: a larger pipe downstream is an expansion, a smaller one a contraction (RCFC Eq. 4.38 and 4.39). At a junction the size change is part of the junction loss. The junction loss is the larger of the momentum result and what keeps the energy line from rising through the junction; in part-full flow the depth above the junction comes from the momentum balance with the water depths, as WSPG does. A pipe asked to carry more than it can flow part full runs full under pressure.

`Losses` on the Mode bar sets how structure losses are figured for the project. `RCFC` (the default) uses the RCFC Hydraulic Design Manual: Thompson's equation at junctions, K = 0.05 at manholes and the entrance and exit losses at catch basins. `AASHTO` uses the AASHTO method, as StormCAD applies it, at every catch basin, inlet, manhole and junction: an expansion loss of 0.35 times the velocity head of the main inflow pipe, a contraction loss of 0.25 times the velocity head of the outlet pipe, and a bend loss by the deflection angle (0.70 at 90 degrees), all increased 30 percent when 10 percent or more of the outflow enters from the surface, and halved where the structure's floor is shaped or benched. These are StormCAD's AASHTO defaults. With AASHTO on, an `AASHTO Losses` strip above the lines shows the four coefficients (Expansion Ke 0.35, Contraction Kc 0.25, Shaped floor Cs 0.5, Surface inflow Cn 1.3). Change them to match an agency's StormCAD settings; they are saved with the project, `Defaults` puts them back, and the report prints the values used and notes any that were changed. Velocities are the actual flowing velocities and the loss is added to the HGL. With AASHTO chosen, each structure's segment

details include Bend (°), the main line's change in direction there (0 for straight through), and Shaped floor. Pipe bends, angle points, the outlet, and size changes away from a structure keep the RCFC losses. The report states which method was used. The WSPG export is not affected.

Tick Existing in a segment's details for a pipe already in the ground. An existing pipe carries flow in the analysis like any other pipe, but auto-size never changes its size. It is drawn dashed on the profile, and its label and the calculation sheet mark it EXIST. A plan import ticks it for you when the plans label a pipe as existing (EXIST. 24" RCP, EX 18" SD, (E) 30") or label both of its ends as existing inverts; crossings of other utilities drawn in the profile (EX 8" W, sewer, gas) are not counted. When a plan set is added to an open project, its existing pipes that repeat a stretch the open line already has are not added a second time.

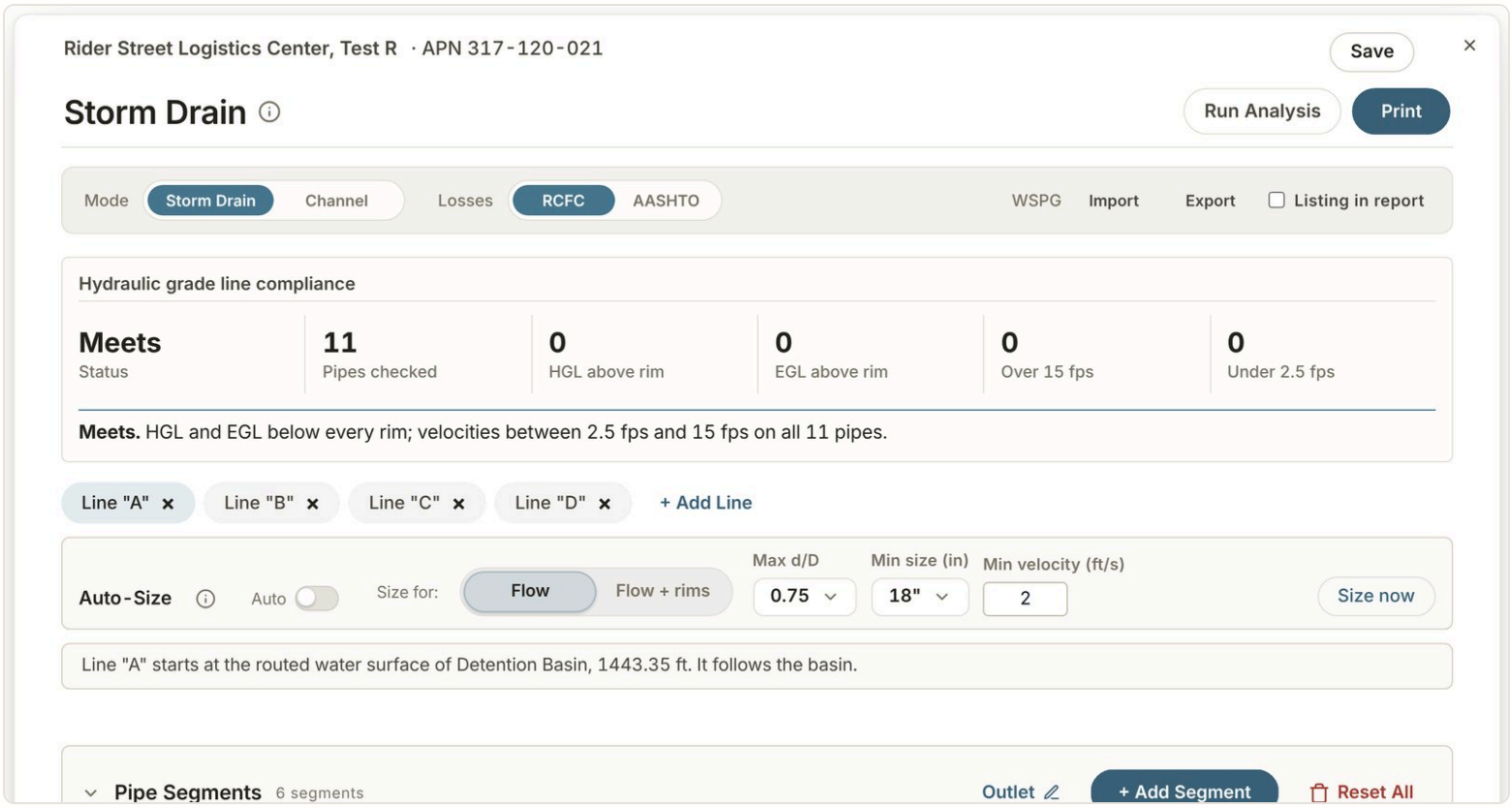


Figure 10. Storm Drain: lines, analysis buttons and the compliance panel.

Segment fields

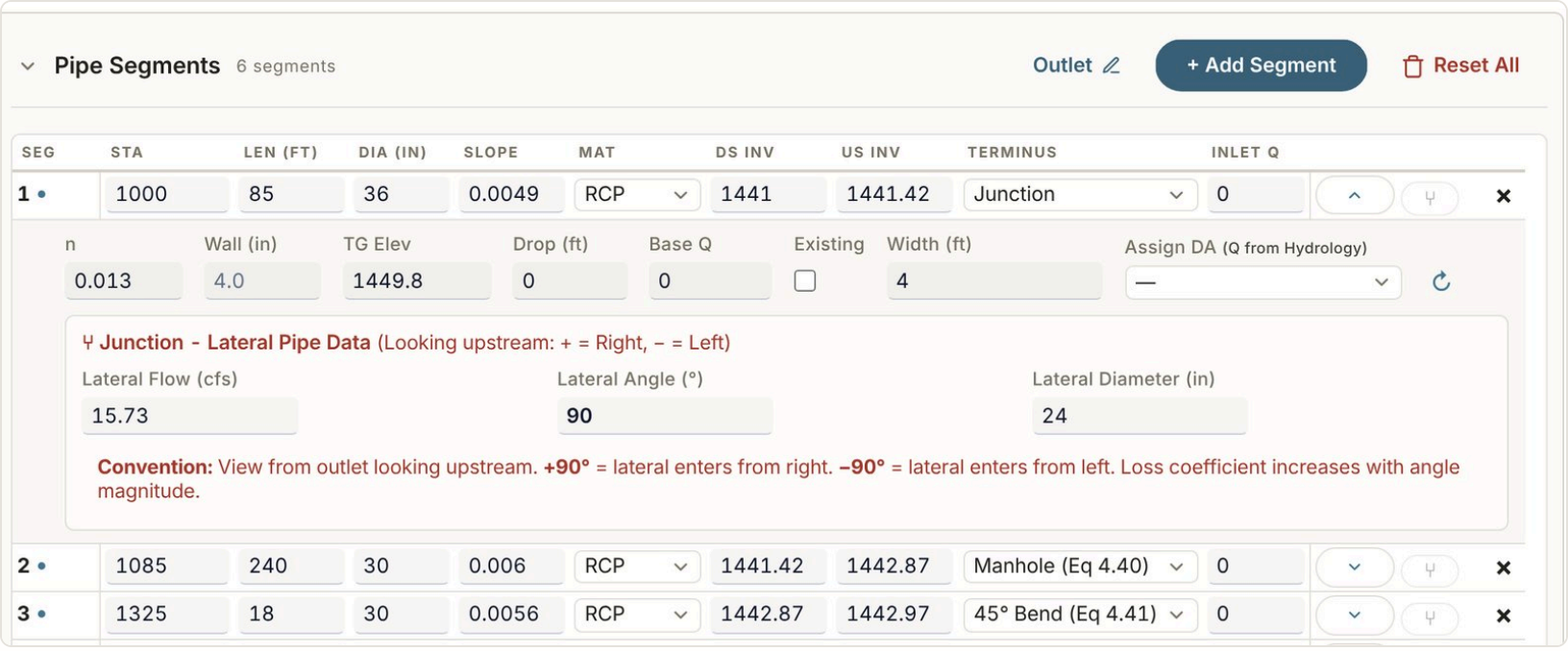


Figure 11. Pipe segments, with pipe 1 open to its details (n, Wall, TG Elev and the rest).

Field	What to enter
SEG	The pipe number (1, 2, 3 ...), the same number the profile shows as PIPE 1, PIPE 2 and so on.
STA	The downstream station of the segment.
LEN (FT)	The segment length.
DIA (IN)	The pipe diameter. For a box (material RCB) this column becomes SIZE (FT): the box span and rise, for example 14 × 7.
SLOPE	The pipe slope, ft/ft, shown to four decimals when it needs them (0.0046). Changing an invert recalculates it.
MAT	The pipe material (RCP, HDPE, PVC, CMP or RCB). Sets the default Manning's n (RCB 0.014, RCFC Table 6.1). RCB makes the segment a reinforced concrete box.
DS INV, US INV	The downstream and upstream invert elevations.
TERMINUS	The structure at the upstream end: catch basin, manhole, junction, bend, transition and others. The RCFC loss equation used for each is shown in the list.
INLET Q	The flow entering at the upstream structure. Use Assign DA rather than typing a value.
n, TG Elev or Rim Elev, Drop, Base Q, Width	In the segment details: Manning's n, the top of grate (catch basins and inlets) or rim elevation (manholes and other structures) that the freeboard is measured to, a drop at the structure, a base flow, and the structure width.
Wall (in)	In the segment details: the pipe wall thickness. Leave it blank for the usual wall for the size and material (RCP D/12 + 1 in, HDPE and PVC from their outside diameters, CMP 0.5 in, box 8 in). The profile draws the outside of the pipe with it, and cover is measured from the top of the outside wall.
Assign DA	The drainage area whose peak flow enters at this structure.
Lateral flow, angle, diameter	For a junction: the lateral's flow, its angle to the main line (positive from the right, looking upstream) and its diameter.

The Outlet window

Click `Outlet` to set where the line discharges, and select the outlet type. For a basin, select **Basin** and then the basin (route it in Stormwater first). Its routed maximum water surface becomes the starting water surface and is updated each time the basin is routed. For an outfall, enter the starting water surface, or leave it blank to start at normal or critical depth. Enter an outlet description for the report, then click `Done`.

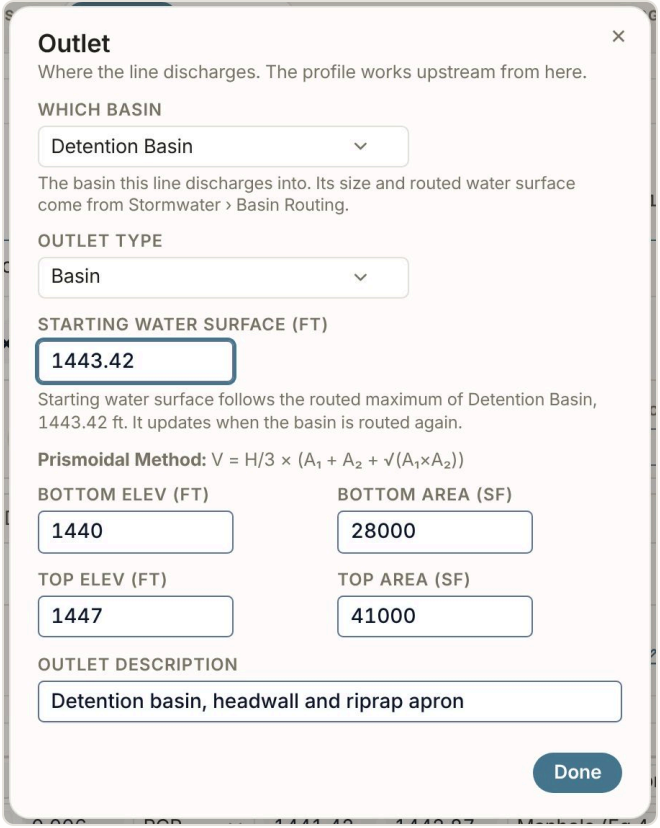


Figure 12. The Outlet window.

Laterals and junctions

Enter a lateral as a separate line with a junction outlet at the station where it connects to the main line. The HGL of the main line at the junction is used as the starting water surface for the lateral, and the lateral flow is added to the main line at the junction. The Flow at Nodes table in the calculations lists each point where flows combine.

Reading the results

The compliance panel shows whether the HGL and EGL are below all rim elevations and whether velocities are between 2 and 15 fps. The calculation table lists the flow, capacity, velocity, flow regime, HGL and freeboard for each segment. The friction loss in each row is the friction slope added up along the segment's water surface profile. A water surface profile at 25-ft stations is provided for each segment.

`Auto-Size` selects pipe diameters based on a maximum d/D, minimum pipe size and minimum velocity. Box segments keep the size you enter.

`Size for` picks what the pipes are sized for: `Flow`, or `Flow + rims` (then raised until every pipe clears the rims). Choosing it does not size anything by itself. `Size now` sizes the line once. Turn `Auto` on to size the line now and again each time you change a flow, slope or invert. A window shows how far along the sizing is. The result table scrolls inside its card, like the pipe table.

Box culverts. Set a segment's material to `RCB (box)` and enter its span and rise in feet. SDX runs the box through the same HGL method as a pipe, with the box's own area, wetted perimeter and top width; critical depth is $(q^2/g)^{1/3}$, with q the flow per foot of span. A line can mix pipes and

boxes. The calculation sheet, profile, cross section and WSPG deck all show the box size, and the WSPG deck writes it as a covered box (channel type 3). Box sections are not read from plan PDFs yet.

Profiles

The profile view shows the pipe, structures, HGL and EGL for each line. The pipe is drawn with its inside (invert and crown) and a thin line for the outside of the wall, on screen, in the report, and in the DXF (layer SDX-PIPE-OD). Each pipe has its own label along the pipe with its number, size and slope (PIPE 2 30" RCP S=0.60%), just outside the wall (a boxed label with a leader when the pipe is too short). Every segment break has a STA and INV callout below the pipe. Its leader starts at a small circle on the invert and runs into a line under the station; INV sits under the line (INV IN and INV OUT when the two inverts differ), and a bend adds its name as the third line. Structures show Rim at the top of the shaft and one callout beside it, with EGL above the line and HGL, Inv and Depth below, in elevation order. Drag a callout to the other side of its point and the leader moves to the near end of the line. Labels always sit on top of the lines, and every leader ends in a small circle. The legend swatches are taken from the lines as drawn. Velocity under 2.5 fps or over 15 fps is flagged in red, 10 to 15 fps in amber. In the report, a long line prints on several sheets of about 450 ft (fewer feet where structures are close together), with a match line and the next sheet number at each cut. Labels can be dragged to a new position, and the positions are saved with the project. Click `Reset view` to return the labels and zoom to their default positions. Use `DIR` to change the drawing direction.

Labels that would land on top of each other, or across a structure, are spaced apart on their own, with a thin leader back to their spot. Drag any label to place it yourself; it stays exactly where you let go, and the report sheet, the full scale print and each sheet of a long line put it in the same spot relative to the drawing. Zoom the profile with the mouse wheel or a trackpad pinch. Move around by dragging, or by swiping with two fingers on a trackpad.

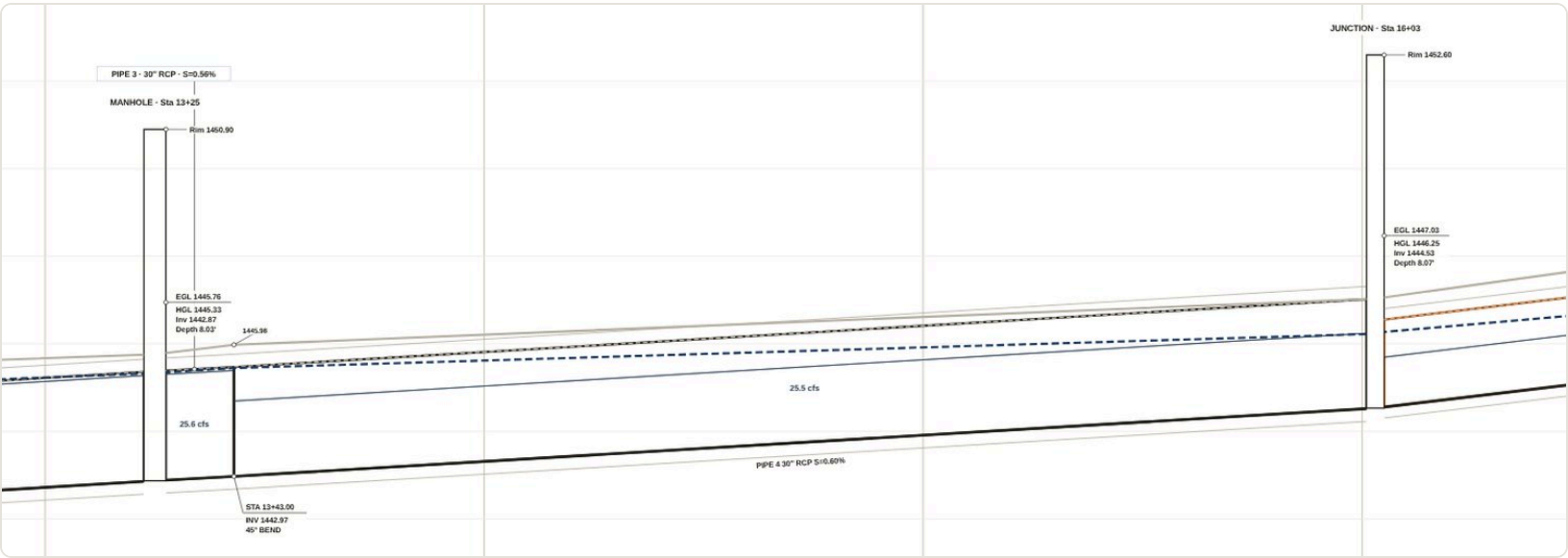


Figure 13. The profile view: STA and INV callouts under the pipe, and a structure callout beside its shaft.

To view a pipe cross section, click on the profile or enter a station under `Section`.

Set the horizontal and vertical scales with the H and V selectors. The Export options are:

- **Print / Save PDF:** select Report sheet (letter landscape, fitted to the page, not to scale) or Full scale (24×36 sheets at true size, at the selected H and V scales; a long line runs onto more sheets with match lines, and a line too tall for the sheet moves to the next V scale, which the sheet states).
- **Image (SVG):** downloads the profile as a vector image.
- **CAD (DXF):** downloads a DXF drawn at the selected scales, for paper space in CAD.

WSPG

The WSPG controls are on the right of the Mode bar. Click Export to create a WSPG input file (.WSW) and a profile listing in WSPG format. The input file carries the same flows SDX ran, with confluences applied. Click Import to read a WSPG input file into a line. Select Listing in report to include the listing in the hydrology study.

Print

Click Print, at the top right beside Run Analysis, to print the hydraulic calculations, with or without the profiles.

Point at a pipe segment in the table, or click into one of its fields, and the profile outlines that pipe. It works the other way too: point at the profile and the matching row in the table lights up.

Each section (Pipe Segments, Profile) folds away when you click its heading, the same as the sections on the Hydrology tab. SDX remembers which are folded.

A long line shows about 12 pipe segments at a time. Scroll inside the table to see the rest; the column headings stay at the top and the profile stays in view below.

Channel mode

Click Channel in the Mode bar to analyze an open channel instead of a pipe network. Click + Add Section for each cross section, enter its shape, dimensions, lining and slope, and click Analyze Channel at the top right. Enter the reach's **Design Q** and SDX finds the normal depth and fills in the water surface. Leave Design Q blank and SDX gives the flow the typed water surface carries. Click Draw Cross Section to view a section, and Print to print every section. Channel sections save with the project.

7 Drainage Capacity

The Drainage Capacity app checks inlets, street flow and outlet protection. Pick the calculator in the Calculator bar, then add one structure for each inlet or outlet with `+ Add Catch Basin` (or Grate Inlet, Street Section, Riprap Design) beside the structure chips. Use the same name as in the storm drain (for example CB A-6). A catch basin takes 50% clogging in a sump and none on grade unless you enter a Clogging (%) of your own. A drop inlet grate takes 50% clogging the same way unless you enter your own. `Print` and `Print All` are at the top right and print the calculator in view.

Tab	You enter	SDX states
Catch basin	Sump or on grade, the flow (or its DA), curb height, cross slope, gutter slope, depression, proposed width	Capture at the standard widths (7, 14, 21, 28 ft) and the width needed for 95% capture. In a sump: the capacity with water at the top of the curb (HEC-22, 50% clogged) and the width that takes all of the flow
Grate inlet	The grate, its flow, the grades around it	Head on the grate (weir or orifice) against the 0.25 ft allowed, and the ponding extent
Street section	Flow, longitudinal and cross slope, curb type, distance to crown	Spread and depth at the curb against the allowed spread
Riprap	The outlet (its line's flow, pipe size), stone specific gravity, stability factor	Outlet velocity (at the outlet flow depth), stone size and class, apron length, width and thickness

On a large monitor (wide layout), an **All catch basins** table below the results lists every catch basin in the project: flow, width, captured flow, bypass, efficiency, ponding depth, the width that takes all of the flow, and whether it meets. Click a row to open that catch basin. The **System** card beside it totals the flow to the inlets, the flow captured and bypassed, how many inlets meet, and the highest ponding and largest bypass with the inlet each comes from.

Catch basin fields

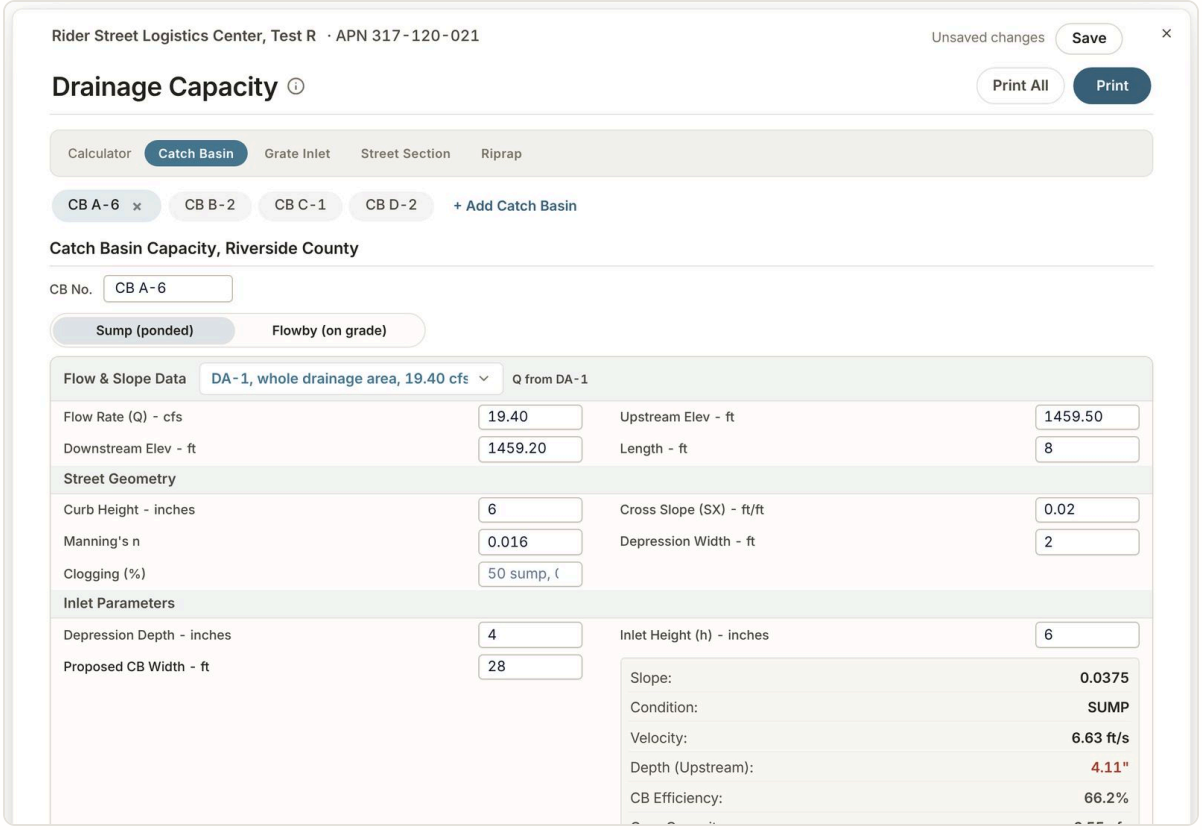


Figure 14. Drainage Capacity: a catch basin.

Field	What to enter
CB NO.	The catch basin name, the same as in the storm drain.
Sump (ponded) / Flowby (on-grade)	Sump for an inlet at a low point. Flowby for an inlet on a continuous grade.
Flow rate (Q)	The flow to the inlet. Type it, or pick a source from the list beside it: a whole drainage area (fills Q), or one tributary area (fills Q and the gutter slope and length). A flow picked from Hydrology updates when Hydrology changes.
Upstream elev, Downstream elev, Length	The gutter grade, used for the longitudinal slope.
Curb height, Cross slope (Sx), Manning's n	The street section at the inlet.
Depression width, Depression depth	The local depression at the inlet.
Inlet height (H)	The curb opening height.
Proposed CB width	The opening width to check. 7, 14, 21 and 28 ft are standard.

Until every input is in, the Condition line says what is still needed. Each structure's chip shows its CB NO. (or grate number, street or outlet name).

Grate inlet fields

Field	What to enter
Grate inlet no.	The grate name.
Flow rate (Q)	The flow to the grate.
Grate	The grate model and size.
N, S, E, W	The ground slope away from the grate in each direction, in percent. Used for the ponding extent.

Street section fields

Field	What to enter
Street section	The street name.
Flow (Q)	The gutter flow.
Slopes, Cross	The street grade and the pavement cross slope, ft/ft.
Curb	The curb type.
Curb to crown	The distance from the curb face to the street crown, ft.
Manning's n	The pavement roughness.

Riprap fields

Field	What to enter
Outlet	The outlet location, for example Line A outlet to the basin.
Flow (Q)	The outlet flow, or pick a source from the list beside it (a line's outlet, a structure, a drainage area or a tributary). With no drainage areas or storm drain lines in the project yet, the list says so; type the flow.
Discharge type, Dia	Circular pipe or box, and its size in feet (a 30-inch pipe is 2.50). The size in inches shows beside a pipe diameter as a check. Picking a line's outlet as the flow fills it in.
Stone, C	The stone specific gravity and the Isbash stability factor C: 0.86 for high turbulence, 1.20 for low. The first design starts at 2.65 and 0.86. Each new design takes the values last used in the project, so change them once and they carry to every outlet; any design can still be changed on its own. A missing or impossible value shows a note in the results instead of a size.
Apron length, Apron width	Optional. Enter them to check a proposed apron, then click Recalculate with Manual Dimensions.

Each printed sheet begins with a result (Meets, Sized, Review or Does not meet) followed by a short explanation.

8 The report

SDX generates the complete hydrology study as a single PDF, including the cover, the project summary (the results, project and rainfall details, and the engineer's certification with signature, date and stamp spaces), table of contents, narrative, exhibits, calculations, profiles and appendices.

The Generate Report window

Click `Generate Report` in Hydrology to open the report window. It contains:

Section	Use
Setup (questions 1 to 5)	Jurisdiction, what you are designing, the return periods required, the rainfall source and the soils data. These set which parts the report includes.
Governing criteria	Retention design storm, required drawdown time, design and measured infiltration rates, and the infiltration source report.
Site data	`Fetch site data` retrieves the FEMA FIRM panel, flood zone and effective date for the site. The site maps are kept after the first build, since the location does not change, so later builds are faster; clicking Fetch site data again gets fresh maps at the next build. If FEMA, the soils service or the county parcel service does not answer, a red note under the button says which one; try again later.
Narrative	`Auto-Draft` writes the eight narrative sections from Project Setup (Chapter 3). Each section can be edited in its box.
Report date and maps	The date printed on the report, and `Attach exhibit PDFs` for the existing and proposed hydrology maps.
Parts	A list of the calculation sheets that can be bound into the report (storm drain calculations, profiles, basin routing, catch basins and others), each marked included or not included. The storm drain, basin and Drainage Capacity sheets that have results are included to start with.
Buttons	`Preview` shows the report without saving. `Build Report PDF` assembles and saves it. `Cancel` closes the window.

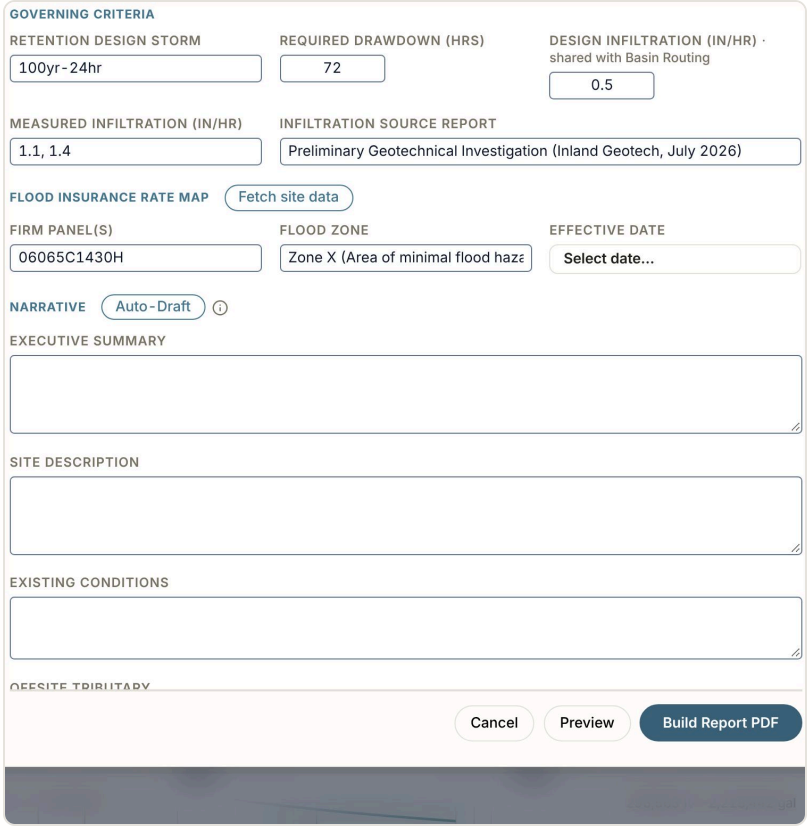


Figure 15. The Generate Report window.

Before you generate: readiness

The Report Readiness panel lists the information required for the report and shows how many items are complete. A filled dot means the item is complete, an orange dot means it needs review, and an empty dot means it is missing. Click an item to go to the related input. See Appendix C for a description of each item.

Hydrology maps

Click **Attach exhibit PDFs** in the Generate Report window and select the existing and proposed condition hydrology maps. They are added at the end of the report.

Generate

1. Click **Generate Report**.
2. SDX retrieves the site exhibits (vicinity map, soils map and FEMA map), drafts the narrative and assembles the report. The status line shows the progress.
3. Review the report in the preview window, then save the PDF. If a map service did not answer and something was left out (site exhibits, FIRMette), a red note at the top of the preview says so; build again later to include it.

9 Tools

The Tools app contains stand-alone calculators, the O&M plan generator and the inlet bypass calculator. Each is a section with its own heading; click a heading to fold it.

Button	What it does
Open CMP Calculator	Sizes a corrugated metal pipe retention system.
Open Drywell Calculator	Sizes drywells, with a construction detail.
Open PICP Calculator	Sizes permeable interlocking concrete pavement.
Generate O&M Plan	In the O&M Plan heading. Opens the operation and maintenance plan for the BMP types you check in the report preview, ready to download as a PDF.

The CMP, drywell and PICP calculators open below their cards, inside the Calculators section. Click the same button again, or ×, to close one. Enter the design volume or flow and the site data, then press Calculate System and print the sizing sheet: inputs, summary, status, detail, calculation, stage-storage table and, after Send Inflow, the routing. Their results are entered by hand in Stormwater where a basin needs them. A drywell's Total Storage is the well plus its rock voids. Each calculator checks its inputs before it calculates and names the first one to fix. The safety factor is 1 or more. A CMP system's Total System Storage is counted to the top of the stone. On the paver calculator, the routing lists the volume that left over the weir and the volume that overflowed with the storage full.

The same three calculators are free to use at sdxstorm.com/calculators without signing in. There the peak inflow and time of concentration are typed in on the Basin Routing tab. Tc is from 1 to 10,000 minutes.

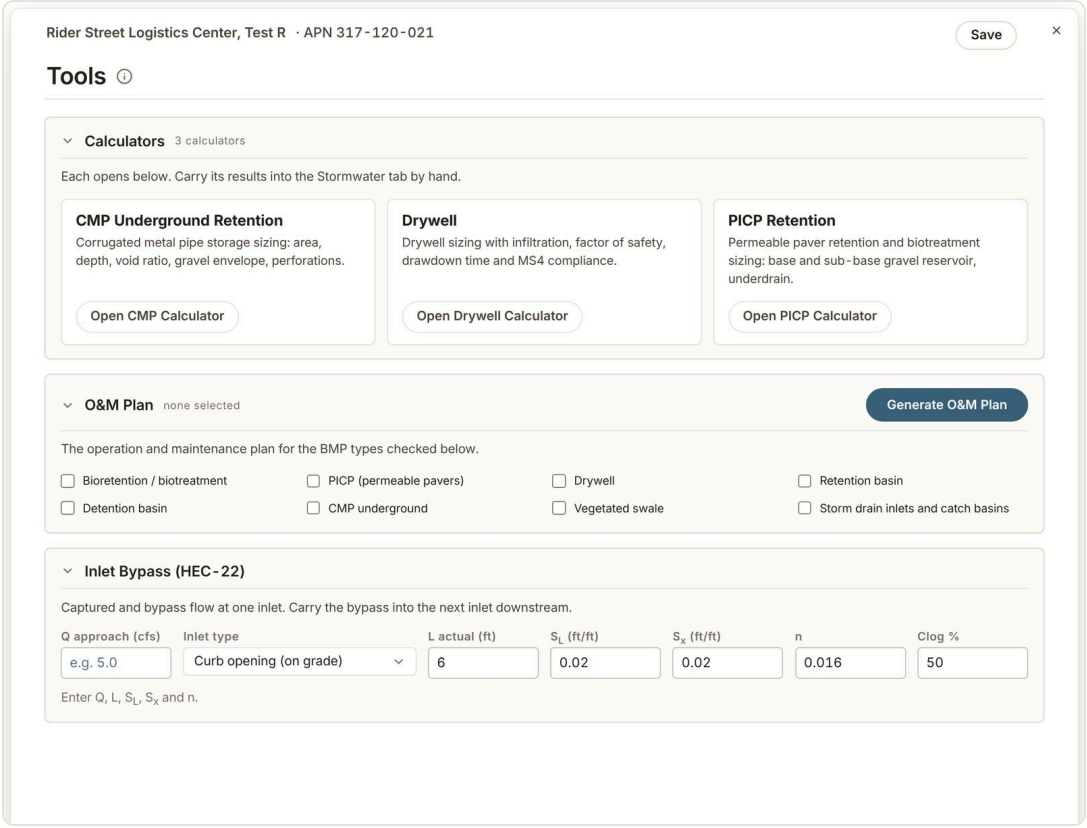


Figure 16. The Tools app.

O&M Plan Generator

Check each BMP type the project uses and click **Generate O&M Plan** in the section heading. The heading shows how many types are checked. The plan opens in the report preview like every other SDX printout. Click **Download PDF** to save it. It is the operation and maintenance attachment that WQMP plan check requires.

Inlet Bypass / Interception Efficiency

For an inlet on a continuous grade, this calculator finds how much of the gutter flow the inlet captures and how much bypasses it, by HEC-22. The section heading shows the efficiency and the bypass flow.

Field	What to enter
Q approach	The gutter flow arriving at the inlet, cfs.
Inlet Type	Curb opening, grate, combination, or sag (at a low point).
L actual	The length of the curb opening or grate along the gutter, ft.
Grate W	Grate and combination only: the grate width across the gutter, ft. Left blank, the grate is taken square and the result says so.
S_L, S_x	The gutter's longitudinal slope and the street cross slope, ft/ft.
n	Manning's n of the gutter.
Clog %	The clogging allowance.

The results show the interception efficiency, the flow captured and the flow that bypasses. To follow a chain of inlets, enter the bypass flow as the next inlet's Q approach. A sag inlet takes all its flow in the end; the result gives the depth and spread at which it does.

10 Troubleshooting

What you see	What to do
Signed out unexpectedly	Your account was used to sign in on another browser, which signs out the first one. Sign in again; if it keeps happening, someone else may have your password. Use **Forgot password?** to set a new one, which signs every browser out.
"Too many requests for this seat"	Wait one minute and try again. If the message continues, contact support.
A project loads slowly	Large projects can take several seconds to load. Wait for the progress window to close.
A narrative sentence reads oddly	Check the wording of the related Project Setup entry. See Chapter 3.
`____` in the narrative	A Project Setup entry is blank. The Report Readiness panel lists it under Narrative blanks.
Storm drain flows don't match the hydrology	Use **Assign DA** for each inlet instead of entering flows by hand.
Rainfall differs between existing and proposed	Download the rainfall again in either scenario. It is applied to both.
A catch basin "does not meet"	Increase the catch basin width, change to a sump inlet, or add an inlet upstream.
A profile label overlaps	Drag the label to a new position. The position is saved with the project.
Prints show TRIAL / NOT FOR SUBMITTAL, or EDUCATIONAL USE - NOT FOR SUBMITTAL	The report was printed with a trial or education key. Reports printed with a licensed key are not marked.
CAD (DXF), Image (SVG) or Save deck says it is not part of this license	Trial and education keys do not save these files. Print or Build Report PDF instead.

For other questions, email the project file and a screenshot of the problem to keith@ccocivil.com.

A Quick start: a complete project

This appendix walks through a complete project, from a new project to the finished report. The example is a small commercial site with one storm drain line draining to one detention basin.

Step 1. Start the project

1. On the home screen, click `New Project`.
2. Click `Project Setup`.
3. Enter the Project Name, the Site Address (APN, street and city) and the Jurisdiction. Click `Detect` next to Site Coordinates to look up the latitude and longitude.
4. Select the Existing condition, On-site conveyance, Discharge / disposition, Off-site flows and Emergency overflow. Enter the Historic discharge point. Word each entry as described in Chapter 3.
5. Enter the Engineer Name and PE / RCE No. Click `Done`.
6. Click `Save Project` and save the file with your project records. Save often as you work.

Step 2. Rainfall

1. Open **Hydrology** and select the `Prop 100-year` scenario.
2. Under IDF Intensity Chart, select `NOAA Atlas 14` and click `Fetch 100-yr` (the button names the storm selected). A, B and n are filled in and the IDF curve is drawn.
3. Repeat for each storm you need. Existing and proposed scenarios of the same storm share the rainfall, so each storm only needs to be fetched once.

Step 3. Tributary areas

1. Click `+ Add Area`. The first row of a drainage area is its initial area.
2. Click `Details` on the row. Enter the area by soil group and the development type. **Initial area** is already ticked: enter the flow length L and fall H under it.
3. Add a row for each additional area along the flow path and set its DA in the DA column. Enter its area, development type, and the travel reach (street, private drive or pipe), with its length and slope.
4. To start another drainage area, add a new initial area and set its DA number.
5. Select the existing condition scenarios and enter the existing site the same way.

Peak flows and times of concentration update as you enter data. The Drainage Area Summary lists the peak flow at each DA outlet.

Step 4. The basin

1. Open **Stormwater** and the `Basin Routing` tab.
2. Check the drainage areas that drain to the basin, and pick the `Storage system` (Open Basin for a basin).
3. Enter the basin bottom and top elevations and areas, the outlet (for example an orifice, its size and invert elevation) and the spillway width and crest.
4. Click `Run Routing Analysis`. Confirm the freeboard is adequate and the peak outflow does not exceed the existing peak flow.

Step 5. The storm drain

1. Open **Storm Drain** and click `+ Add Line`.
2. Click `Outlet`, select the basin, and click `Done`.
3. Click `+ Add Segment` for each pipe, starting at the outlet. Enter the station, length, diameter, slope, material, inverts and the structure at the upstream end.
4. For each catch basin, open the segment details and use `Assign DA` to take the flow from Hydrology.
5. Click `Run Analysis`. Check the compliance panel and review the profile below the table.

Step 6. Inlets and outlet protection

1. Open **Drainage Capacity**. Add a catch basin for each inlet and give it the same name as in the storm drain (for example CB A-1).
2. Select Sump or Flowby, take the flow from the drainage area, and enter the curb and gutter data. The results update as you type.
3. Add a riprap tab for each outlet into the basin and click `Calculate`.

Step 7. The report

1. Return to Hydrology and click `Generate Report`.
2. Answer the Setup questions, complete the governing criteria, and click `Fetch site data`.
3. Click `Auto-Draft` and review the narrative.
4. Attach the existing and proposed hydrology maps.
5. Review the Report Readiness list and complete any missing items.
6. Click `Build Report PDF`, review the preview and save the PDF.

B Wording cheat sheet

A summary of the Project Setup wording described in Chapter 3.

Field	Finishes this	Example
Project name	"___ (APN ...) is located at ..."	Rider Street Logistics Center
Street	"is located at ___ in ..."	2350 Rider Street
Jurisdiction	"... in ___."	the County of Riverside
Historic discharge	"to the existing point of discharge at ___."	the Rider Street right-of-way at the southwest corner
Offsite / overflow note	a phrase after a comma, or a sentence of its own	conveyed in a 24-inch pipe through the site to the basin
Infiltration source	"per the ___"	Preliminary Geotechnical Investigation (Inland Geotech, July 2026)
Measured rates	"measured rates of ___ in/hr"	1.1, 1.4

Do not include labels or end entries with a period. Include "the" where the sentence requires it, and spell out abbreviations.

Readiness items, A to Z

Each item in the Report Readiness panel and what is required to complete it.

Item	Ready when
APN	Project Setup has the parcel number.
Basin freeboard	The routed water surface stays the required freeboard below the rim.
Client	Project Setup names the client.
Conclusion	The conclusion paragraph is drafted.
Drainage concept	Conveyance and disposition are chosen.
Emergency overflow	A basin has a spillway or overflow path stated.
Engineer of record	Name and license number are entered.
Executive summary	The summary is drafted.
Existing / offsite / proposed	Those paragraphs are drafted.
Existing vs proposed	Both conditions cover the same site area and drainage areas.
FIRM	The FEMA panel is known (fetched with the site exhibits or entered).
Firm	Your firm comes from your license and is shown in Settings. Older keys issued without a firm let you type it in Settings.
Governing criteria	The design storm the agency requires is chosen.
Hydrology	The tributary table has areas.
Hydrology maps	Existing and proposed maps are attached.
Inlet capacity	Every catch basin in the storm drain has a capacity check that captures its flow.
Methodology	The methodology paragraph is drafted.
Narrative blanks	No `____` left in the narrative.
Project name	Project Setup has a name.
Project type	The project type agrees with the drainage concept.
Purpose of study	The purpose paragraph is drafted.
Rainfall by scenario	Existing and proposed use the same rainfall at each storm.
Rainfall depths	The depths match the source the study names.
Repeated text	No paragraph says the same thing twice.
Report date	A date is set.
Routing inflow	The basin is routed with the study's hydrograph.
Scenarios	Existing and proposed are run at the study's storms.

Item	Ready when
Site description	The site paragraph is drafted.
Site exhibits	Vicinity, soils and FEMA maps are fetched.
Sizing storm	The storm that sizes the storage is stated.
Soils on the map	Every tributary's soil group appears on the soils map.
Storm drain flows	Every inlet flow comes from the hydrology (use Assign DA).
Study type	Preliminary or Final is chosen.
Tributary area data	The tributary checks pass (areas, coefficients, flows per acre, confluences).
Unit hydrograph	The synthetic unit hydrograph is set up.

D Buttons and windows

This appendix lists the buttons in each app and the windows they open. Most buttons also show a short description when you point to them.

Every app

Button	What it does
Project name (top of the page)	Opens Project Setup.
ⓘ	Shows what the current app or section does.
×	Closes the app and returns to the home screen.

Home screen

Button	What it does
New Project	Starts a blank project.
Save Project	Saves the project to its file, or asks where the first time.
Save, Save as (top right of each app)	Save writes back to the project's file, or asks where the first time (Ctrl+S). Save as, shown once the project has a file, picks a new name or folder (Ctrl+Shift+S).
Load Project	Opens a saved project file.
Import PDF Plans	Imports storm drain lines from a plan PDF, with a review before anything is added.
Project Setup	Opens the Project Setup window.
Settings (gear)	Opens Settings: appearance, layout, and your firm as it comes with your license.

Hydrology

Button	What it does
Generate Report	Opens the Generate Report window (Chapter 8).
i beside Hydrology	What the tab does, the methodology, and the C value ranges and references.
Exist 10-year ... Prop 100-year	Switches the scenario.
NOAA Atlas 14 / RCFC Station / Manual entry	Selects the rainfall source.
Fetch 100-yr	Downloads the NOAA rainfall for the site and fits A, B and n.
2-yr / 10-yr / 100-yr	With RCFC Station selected, applies the selected station's coefficients for that storm.
↻ (next to P24)	Recalculates the 24-hour depth from the IDF coefficients.
Published depths / ↻ Auto	Looks up the published 1, 3, 6 and 24-hour depths, or recalculates them from the IDF.
Open SUH	Opens the synthetic unit hydrograph.
+ Add Area	Adds a tributary area row.
Details	Opens the row details: nodes, soil areas, development type, travel reach, split gutters and Tc method.
x (on a row)	Deletes the row.
Calc / Kirpich	Calculates a time of concentration from length and slope.
↻ Refresh	Updates the multi-scenario comparison.
HCOC Assessment, Form 4.2-3	Opens the HCOC form. Print Form 4.2-3 prints it.

Stormwater

Button	What it does
Import from Hydrology	Brings in flows, times of concentration and areas.
Print Report	Prints the sheet for the open tab.
Tabs (Basin Routing, Outlet Sizing ...)	Switch between calculators. Drag a tab to reorder.
↻ (drainage areas)	Refreshes the drainage areas from Hydrology.
+ Add Manual Q / Add from Storm Drain Line	Adds another inflow to the basin.
Run Routing Analysis	Routes the inflow hydrograph through the basin. The chart shows inflow, outflow and the water stored between them; point at it to read the values at any time. If you entered a basin in the unit hydrograph first, Basin Routing starts from that basin. Above the basin top, the storage table says Over the top. Under Outlet Structure you can set the orifice or weir coefficient, and for a pipe outlet its length, slope, Manning n and entrance loss, so long pipes are limited by the pipe itself. Percolation (in/hr) lets water leave through the basin bottom during the storm.
Clear Results	Clears the routing results.
Calculate Connection Hydraulics	Checks the pipe connecting two basins.
Run All 4 Critical Storms	Routes the 2, 10, 25 and 100-year storms and finds the one that governs.
Generate / Print (3D schematic)	Generate draws the basin in 3D with its water surface, outlet and spillway, labeled with their elevations. Drag to turn it, pinch or use + and − to zoom, and use Depth stretch to make a shallow basin easier to read. Reset view (or a double click) puts it back. The water line turns red when the basin overtops. Print is greyed out until you press Generate, and again after you open another project. It gives a sheet with a cross section through the basin, drawn to scale with the depth stretched (the stretch is noted), a small plan, and the basin and water surface tables. The view also redraws after each routing run.
Calculate Outlet / Size for Target Q	Checks an outlet, or sizes it for a target flow.
Calculate Drawdown	Calculates the drawdown time.
Calculate WQV / Use WQV	Calculates the water quality volume, or sends it to drawdown.
Calculate Bioretention	Sizes the bioretention facility.
Send Inflow	Sends the inflow to the selected BMP calculator.
Calculate HydroDeck	Sizes the HydroDeck system.

Storm Drain

Button	What it does
Mode: Storm Drain / Channel	Switches between pipe networks and open channels.
+ Add Line	Adds a storm drain line (beside the line chips).
Run Analysis	Calculates every line.
Print	Opens the print window (calculations, with or without profiles).
Import / Export (WSPG)	Reads a WSPG deck, or opens the WSPG export window.
Line chips	Select a line. Double-click to rename, drag to reorder, × to delete.
Size for: Flow / Flow + rims	Picks what Auto-Size sizes pipes for.
Size now	Sizes the line once.
Auto	Keeps the line sized as you edit it.
Outlet	Opens the outlet window: starting water surface and outlet type.
+ Add Segment / Reset All	Adds a pipe segment, or clears all segments of the line.
▾ (on a segment)	Shows n, flowline, drop, base flow and drainage area.
⑂	Splits the segment by adding a structure partway along it.
↻ (on a segment)	Refreshes the drainage areas and flows from Hydrology.
Reset view	Returns the profile labels and zoom to the default.
H and V scales	Set the profile scales.
→ / ←	Sets the profile direction.
Section	Opens the pipe cross section viewer.
Print / Save PDF, Image (SVG), CAD (DXF)	Exports the profile.
+ Add Section / Analyze Channel	Channel mode: adds a cross section and calculates the channel.

Drainage Capacity

Button	What it does
Calculator: Catch Basin / Grate Inlet / Street Section / Riprap	Select the type. Right-click for options.
+ Add Catch Basin (and the others)	Adds a structure of that type, beside the structure chips.
Structure chips	Select a structure. Drag to reorder, × to remove.
Flow source list	Takes the flow from Hydrology: a whole drainage area, or one tributary area with its gutter slope and length.
Calculate	Runs the check.
Recalculate with Manual Dimensions	Riprap: rechecks with the apron size you enter.
Print / Print All	At the top right: prints the current structure, or one sheet for every structure of that type.

Tools

Button	What it does
Open CMP / Drywell / PICP Calculator	Opens that calculator below its card. It looks and works the same as on the Calculators page of sdxstorm.com, and the box grows to fit it, so it has no scroll bar of its own.
Generate O&M Plan	In the O&M Plan heading. Prints the O&M plan for the checked BMP types as a PDF.
Inlet Bypass fields	Recalculate as you type; no button.

Windows

Window	Opened by	Closes with
Project Setup	Project Setup, or the project name	Done or ✕
Settings	The gear on the home screen	A click outside it, the gear, or Esc
Start a free trial / Contact us	The links under Sign in on the sign-in page	Request trial or Send, Cancel, ×, or Esc
Generate Report	Generate Report in Hydrology	Build Report PDF, Preview or Cancel
Report preview	Preview, or any Print button	Close
Print (Storm Drain)	Print in Storm Drain	Print or Cancel
WSPG export	Export in Storm Drain	Save deck, Save listing, Save all, Save PDF or Close
Outlet	Outlet in Storm Drain	Done or ✕
Tributary details	Details on a tributary row	✕
Cross section	Section, or a click on the profile	✕
Print Profile	Print / Save PDF under Export	Report sheet, Full scale or ✕
Confirmation	Actions that replace or delete work (Redraft, Reset All, delete)	Confirm or Cancel
Loading project	Load Project	Closes by itself when loading is complete