GRADING AND DRAINAGE

V. GRADING AND DRAINAGE

Grading and drainage addresses the management of terrain and stormwater runoff. The vision from the Community Plan was to develop the Railyards to demonstrate environmentally sound and sustainable practices for stormwater management, including ponding and water harvesting.

Particular goals for the master plan to achieve that vision are:

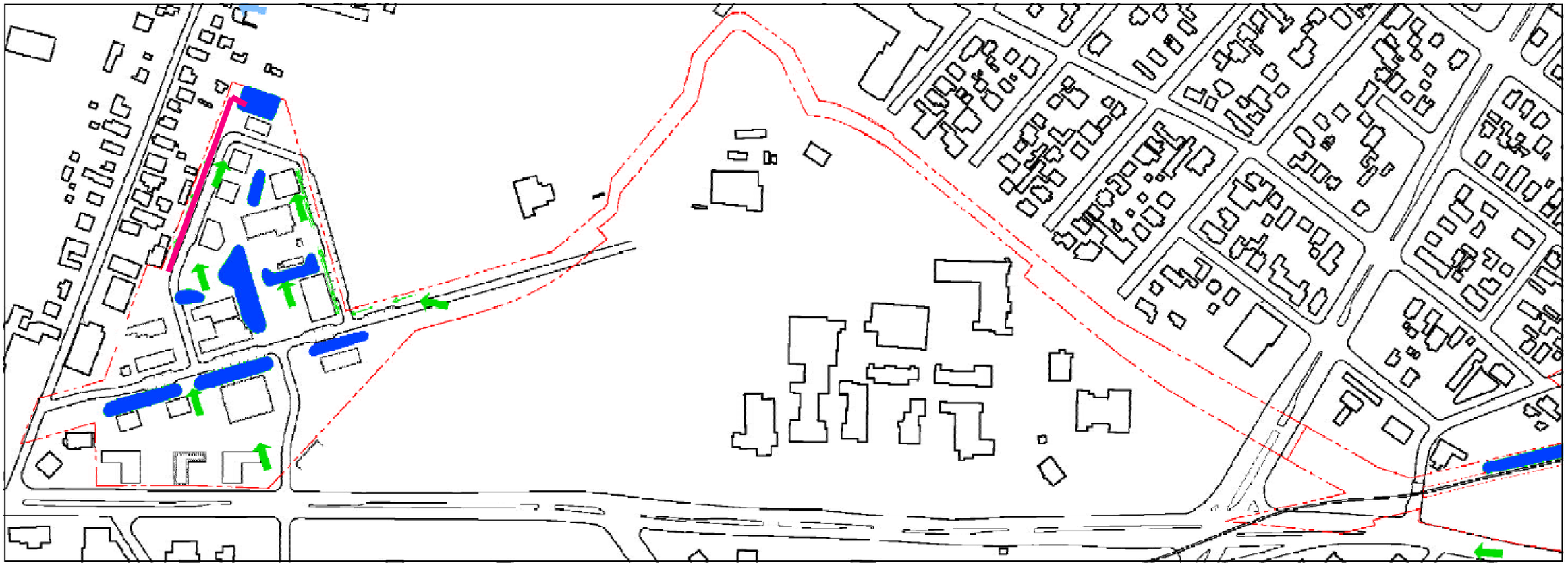
- To design to harvest or collect, rainfall for reuse and to recharge local aquifers.
- To incorporate water quality improvements into the stormwater management system. Water quality is focused on reducing sediments or contaminants in storm runoff.
- To utilize sustainable water harvesting and water quality practices that are appropriate, easy to maintain, and cost effective.

Baca Area Drainage Issues

The Baca Area of the railyard poses several significant challenges in order to achieve the Railyard project's goals for stormwater. The challenges and constraints identified are:

- Stormwater may not be discharged into the Acequia Madre, which triggers a regulatory stormwater retention requirement to hold two - 100 year storm events.
- There is no existing stormwater infrastructure serving the Baca Neighborhood
- A substantial amount of stormwater from Cerrillos Road runs onto the site during storms.
- Normal water harvesting or ponding of stormwater runoff may not be permitted due to the proximity of the City-owned Baca Well and the presence of environmental contaminants on the adjacent PNM site.

Currently, site stormwater - including substantial stormwater that flows onto the site from Cerrillos Road - flows across the Baca Site in a southwesterly direction from the Cerrillos Road edge to the corner of the property next to the City-owned Baca Well Site. The stormwater then runs



westward to the Acequia Madre which acts as the site's off-site stormwater drainage conveyance system.

In discussions with the Acequia Madre Association representatives, they have stated that the current condition where the Baca Area surface drainage flows to the acequia would no longer be allowed. If the outflow location is no longer available, the Baca Site is required by City of Santa Fe development regulations to retain on site the equivalent of two - one hundred year storms. The size of the pond needed to retain that amount of stormwater required, if kept to a safe depth of approximately two feet deep, is two acres in area, a considerable amount of land for stormwater management.

This would not present a problem if there were alternate drainage outflow locations, but presently there are no readily available alternate locations as there is no stormwater infrastructure that serves the Baca Area.

The last issue potentially affecting drainage in the Baca Area is a request by Sangre de Cristo Water Company (SDCW) to verify the subsurface pollution migration potential for the Baca Area.

A surface soil sampling report for contaminants was done for the Baca Site in the spring of 2001. That report indicates that all parameters tested for were below the New Mexico Environment Department soil screening levels for residential land uses. However, due to the proximity of the City-owned well, SDCW has requested that more rigorous testing be performed before ponds are constructed. If the deeper soils test show that there is not a contamination migration problem where water harvesting ponds are proposed, then ponds can be constructed. The Drainage Master Plan (*Figure V-1)* shows potential locations for ponds should this option be possible.

If there are subsurface problems identified, then drainage issues will become more complex. Potential solutions, as a result, may be more limited due to the other site constraints.

If subsurface contaminate migration is an issue, underground stormwater storage and lined ponds might be precluded due to concerns that if they leak there would be water with pressure behind it. (The pressure results due to the weight of stored water.)

An alternative would be to construct a storm drain to convey stormwater runoff from the Baca Area to the Santa Fe River. Approximately one-quarter mile south, down the Acequia Madre, behind the Santa Fe Indian School, the Acequia Madre turns to the west. At this juncture, an arroyo continues to the southwest that leads to the Santa Fe River. A conveyance pipe could be built from the southwest end of the Baca Site to that arroyo. This option is expensive and

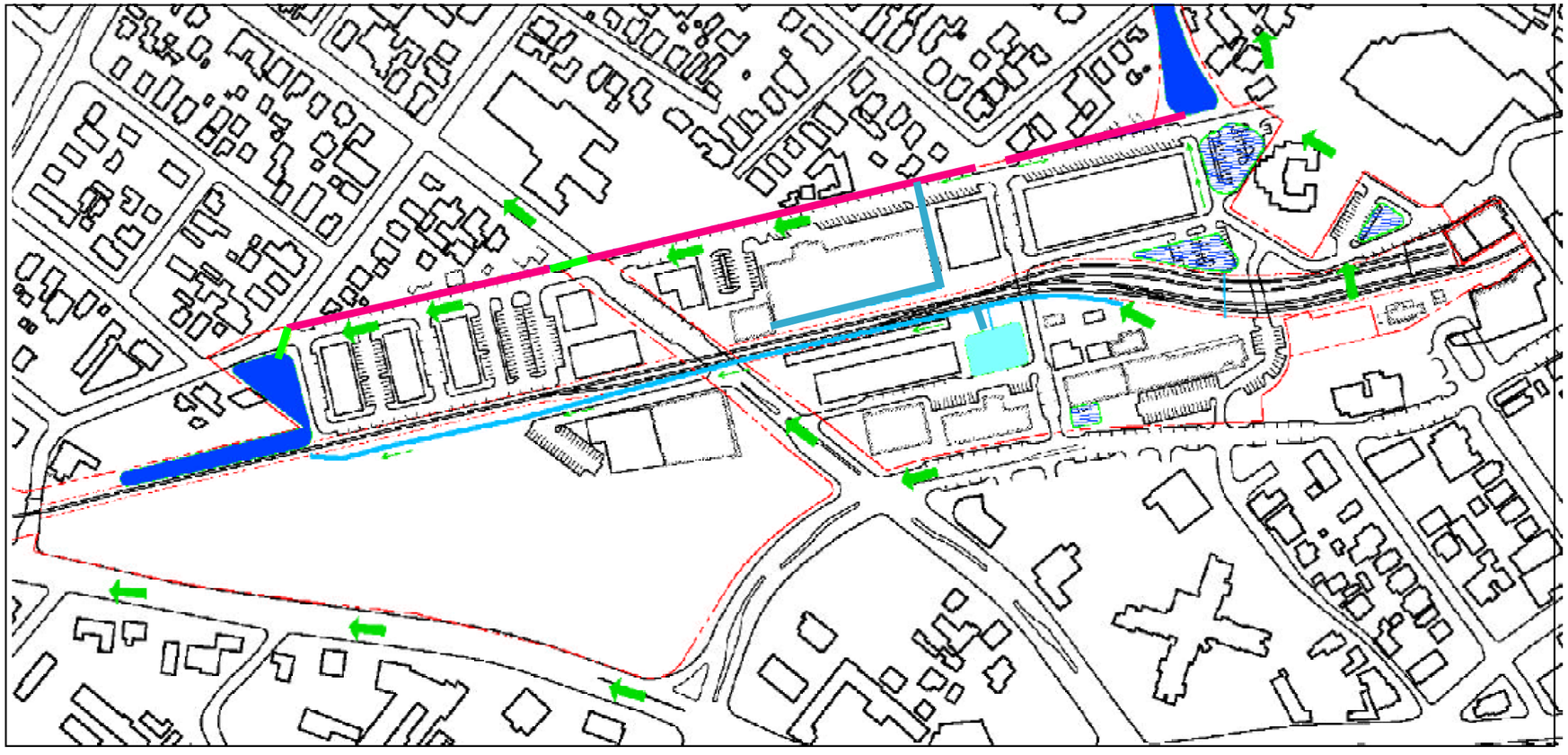


Figure V-1: Grading and Drainage Concept Master Plan

LEGEND

- Existing Arroyo or Swale
- Direction of Flow (Existing Condition)
- Water Harvesting Swale
- Collection Pipe
- Large Scale Infiltration/ Sedimentation Pond
- Shallow Infiltration Pond (~ 6" depth during hundred year design storm)
- Underground Storage or Infiltration Pond

may have right-of-way issues which could be difficult and expensive to overcome. This option requires a detailed right-of-way evaluation study and detailed engineering studies. If this option were selected, many of the issues identified with ponding would still have to be addressed since some ponding would be required to slow developed runoff rates.

Baca Drainage Plan Recommendations

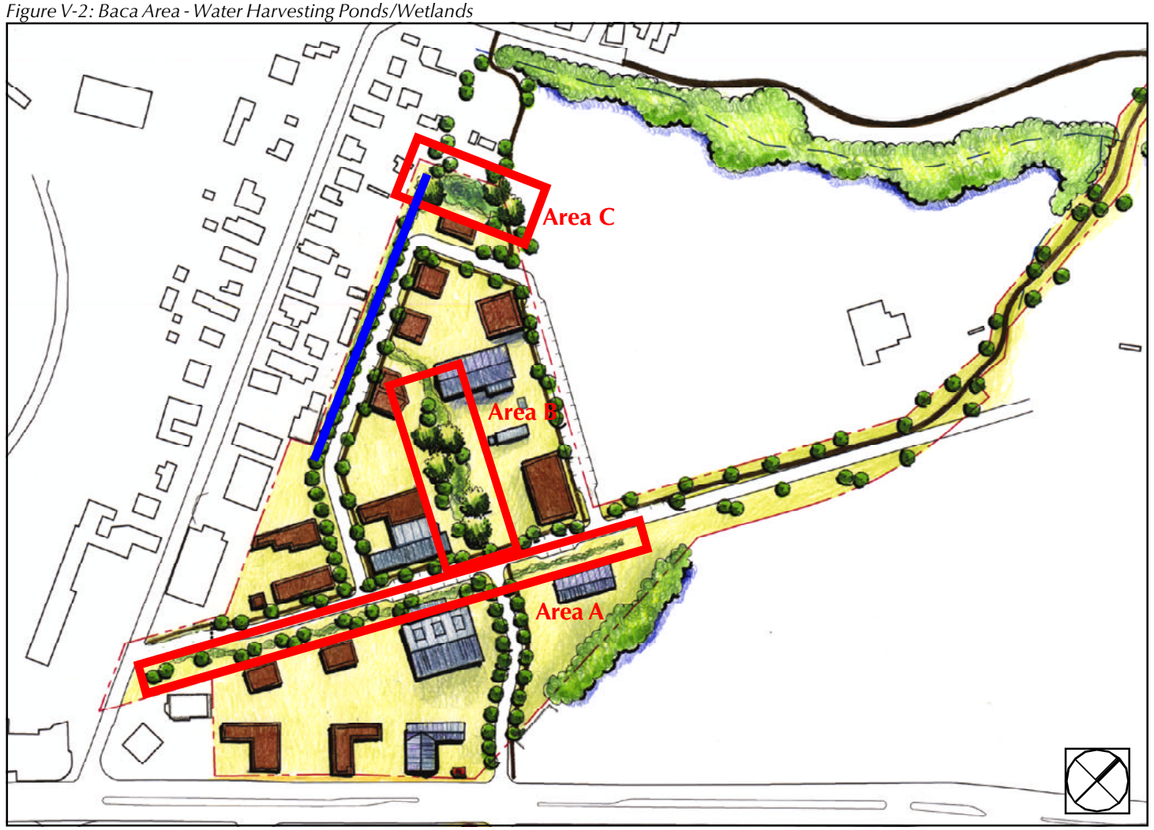
Under the assumption that underground contamination migration is not an issue the drainage plan for the Baca Area is to have a series of dispersed water harvesting/ wetland ponds for stormwater management.

Area A is to the east side of the Baca Paseo. This area had for many years a small wetlands running along the roadside until recent years. The proposed water harvesting/ storm water swale would bring back that pattern. It would collect runoff between Cerrillos Road the the Baca Paseo. It would be planted as a wetlands landscape amenity and part of the long term identity of the site. Where driveways cross the swale, culverts and protections would be needed. An example is the small wetlands, that can be seen on the Captain Marble lot in the Baca Area. *See Figure V-2.*

The second water harvesting/stormwater zone (Area B) is in the center of the site. As the visual end of the entry road into the Baca Area, this wetland should be designed as a landscape amenity. The zone collects drainage from the lots in the center of the site. Each site would direct their stormwater to this central feature and assist in its construction.

The third water harvesting pond (Area C) is at the western most end of the Baca Area. This would capture stormwater from the lowest third of the site and from the water harvesting swale along the edge adjacent to the Baca Street neighborhood. The swale at the west edge is to be designed as a landscape buffer to the neighbors.

Figure V-2: Baca Area - Water Harvesting Ponds/Wetlands



Environmental Review

In April of 2001, an environmental soil sampling report was conducted for the Railyard. The sampling results were compared with New Mexico Environment Department (NMED) soil screening levels to evaluate potentially contaminated areas and contaminates on-site from former railroad activities and other historic and current land uses at the site. In addition, the potential for soil and ground water associated with those uses was also evaluated.

Surface and subsurface soil samples were taken in 80 locations in the North Railyard Area and from 32 in the Baca Area. The sampling results seem to indicate that the tested contaminants are below the screening levels set by NMED in most of the areas. Only five localized areas with potential concern were identified.

A. At a former oil drum location at the northern end of the railroad tracks, south of Outside Magazine. Approximately 100 feet square. Further sampling required.

B. Near above ground diesel storage tank at Wholesale Builders Supply yard. 10 to 15 feet square.

C. Near a drum storage location inside the Ortiz Body Shop fences.

D. A tar pit southwest of the old building site in the proposed park area.

E. A location behind the Texaco Station at the Baca Area.

For each of these locations a specific clean-up recommendation is being prepared for the City.

North Railyard Drainage Plan

Drainage elements within the North Railyard consist of:

- Large water harvesting and water quality ponds.
- Smaller water harvesting ponds.
- A water harvesting swale.
- An underground stormwater harvesting and detention structure.
- An underground storm drain.

A brief description of the function and purpose of each of these elements is provided below.

Located in the Romero Street Wye, a large water harvesting and water quality pond serves several purposes, (see *Figure V-3).* It is an opportunity for runoff from impervious areas to percolate into the ground and help recharge the groundwater aquifer. Infiltration of the water can be encouraged by providing pervious materials in the bottom of the pond and by providing carefully designed dry wells. The pond helps to enhance stormwater quality by providing a location where sediment and other suspended solids can be deposited. Finally the pond also mitigates the peak runoff rate generated by large storm events. The pond will be designed to mitigate the developed peak runoff from the 100-year storm to the rate currently generated from the Railyard site.

There are other smaller water harvesting/detention ponds spread throughout the north end of the Railyard, mostly in parking lots. The parking lots would be paved with interlocking concrete pavers in a manner that allows for permeability, with an appropriate subbase for traffic and infiltration. The total depth of water they would hold in a 100-year storm would be approximately six inches. They serve essentially the same purpose as the large pond. These multiple, smaller ponds, allow the depth of the larger pond to be eighteen inches or less.

Figure V-3: Romero Street Wye Water Harvesting Pond

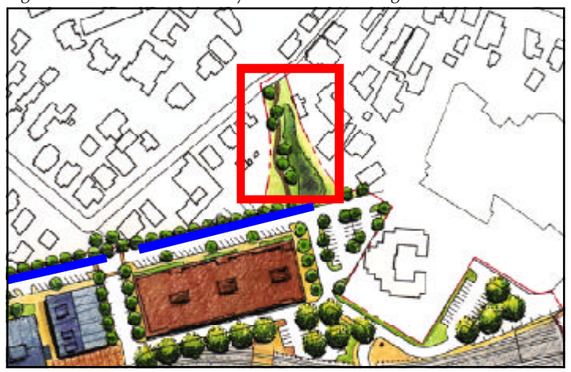


Figure V-4: Plaza Area Subsurface Infiltration Potential Location

Figure V-5: South Alarid St. Drainage Pond

The water harvesting swale shown along the west property line will collect runoff from the portion of the site between the west property line and the railroad tracks. North of Manhattan Avenue the swale will convey stormwater to the north, into the Romero Street pond. The portion of the swale south of Manhattan Avenue will convey flows to a proposed culvert under Paseo de Peralta and continue south to the large water harvesting/water quality pond located near Alarid Street, at the south end of the site. The swale will be designed to reduce the velocity of site runoff, and provide an opportunity for additional water harvesting.

An underground stormwater harvesting and detention structure is proposed for a portion of the Railyard Plaza north of the proposed Farmers' Market building, (see *Figure V-4).* This structure provides for storage and infiltration of stormwater. The structure could accept flows from the nearby roof drains as well as from the storm drain described below.

The underground storm drain within the North Railyard Area will run along the east side of the railroad tracks and will connect to the storm drain within the South Railyard Area. This storm drain will accept runoff from the portion of the site between the railroad tracks and Guadalupe Street, and south of the John Muir building. Water will be collected by a series of drop inlets located along the east side of the tracks. These drop inlets will be designed to contain sediment and to trap floating debris. This will significantly increase the quality of the water. This storm drain will be designed to convey the peak runoff generated by a 100-year storm event.

The drainage system in the Railyard Area south of Paseo de Peralta, as proposed consists of the following:

- A large water harvesting and water quality pond
- A water harvesting swale
- An underground storm drain.

The proposed large pond location is on the site of the existing Ortiz Body Shop. Part of this detention pond is proposed to turn south into an isolated sliver of land west of the tracks. This will require coordination and approval with the Park plans.

The west property line water harvesting swale mentioned in the North Railyard will continue south to Alarid Street, (see *Figure V-5).* This swale collects runoff from the area between the railroad tracks and the west property line, south of Paseo de Peralta. As suggested by its name, the water harvesting swale will serve two purposes: water harvesting and surface conveyance of stormwater runoff. Water harvesting can be achieved by several means, including cobble check dams and dry wells.

The underground storm drain referred to above will convey storm water runoff from the North Railyard under Paseo de Peralta, and into the large southern water harvesting pond. This storm drain prevents runoff from the North Railyards flowing to the Railyard Park. This storm drain will also mitigate the problems being caused by surface runoff at the Paseo de Peralta railroad crossing.

WATER QUALITY

Minimizing impervious surfaces to enhance water quality is an important concept. Impervious surfaces include rooftops, roads, parking lots, and other paving surfaces that shed stormwater and cause water quality problems by washing non-point pollutants such as petroleum, oils, and sediment, into drainage and river systems. Permeable paving and water harvesting are two techniques to mitigate the effects of runoff from impervious surfaces. The Master Pan recommends using permeable and porous paving systems in parking lots or other paved pedestrian areas and installing them to allow stormwater infiltration into appropriately prepared subsoils. Historic site protection concerns would need to be addressed when selecting materials and styles for the North Railyard Area, as it is important to maintain the historic content of the site.

Water Quality Techniques

Many methods exist to harvest, slow, and cleanse stormwater. Three methods are presented below.

1. ***Pond with low flow meander streambed***. *Figures V-6, V-7, V-9 and V-10* illustrate how a stormwater pond can irrigate landscape materials, as well as enhance water quality. The meandering cobbled, low-flow streambed, slows stormwater and facilitates the infiltration of runoff. Reducing the velocity of the stormwater causes sediment to settle in the pond, thereby allowing cleaner water to flow out of the pond. This type of stormwater control supports a variety of vegetation and provides aesthetic and educational opportunities about water in the landscape.

2. ***Water quality inlet***. Drop inlets, *(*see *Figure V-8),* can be specially designed to improve stormwater runoff quality. This is accomplished in two primary ways:

- Extension of the depth of the drop inlet below the invert of the outflow pipe allows for sediment to be captured in the bottom of the drop inlet.
- Installation of a “snout” over the outflow pipe traps floating trash and oils in the drop inlet.

3. ***Underground ponding or water harvesting structure***. This method involves a buried half-pipe on a bed of clean gravel, (see *Figure V-11).* Runoff enters the system through collection pipes. The collected water is able to infiltrate through the gravel into the ground below, and eventually enters the natural subsurface aquifer systems. Alternatively, this collected stormwater could be used in an irrigation system on site.

Figure V-6: Water Harvesting Near Parking Area

Figure V-7: Water Harvesting Landscape

Figure V-8: Snout Drain Detail

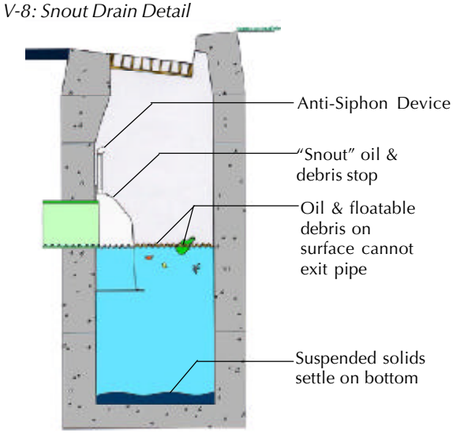
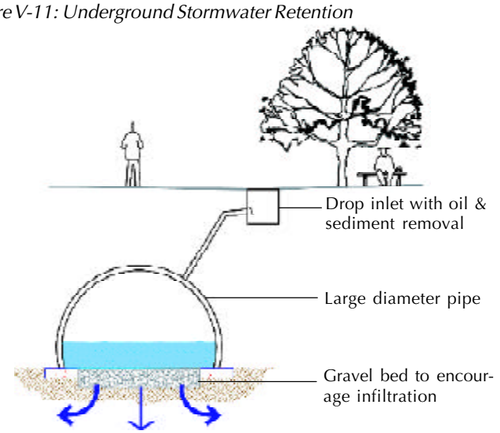


Figure V-9: Water Harvesting Landscape

Figure V-10: Underground Stormwater Retention

Figure V-11: Underground Stormwater Retention



WATER HARVESTING

Water harvesting has many significant benefits, and is strongly encouraged throughout the site. Harvested water can be used for irrigation of plant materials within the Railyard. This can be achieved through “active” or “passive” means. In an “active” system, the harvested stormwater is contained and pumped into an irrigation system.

In a more “passive” system, the stormwater is allowed to infiltrate into the ground in planted areas adjacent to the stormwater source such as a rooftop or planting medians in parking lots, (see *Figures V-6, V-7 and V-9).* All parking areas are to be designed with this type of water harvesting. In the “passive” system, the demand for irrigation is reduced for those plants in the infiltration zone.

Several water harvesting methods are illustrated in these pages, and the method chosen need not be limited to the methods illustrated here. However, designers of water harvesting systems are advised to be cautious about saturating soils which support structures.

Ponding Standard for Hydrologic Purposes

The 100-year peak discharge rate from all portions of the site after the development must not exceed the existing peak runoff rates. To accomplish this, the use of detention ponds are necessary. Detention ponds must be designed to drain within 24 hours. The design storm is the 100-year/24-hour storm. Retention pond volumes, however, shall be calculated using the 100-year/10-day storm.

Costs associated with fulfilling these drainage management guidelines can be significant for affordable and small tenants. To ameliorate these costs, entities leasing sites within the Railyard should be given incentives to mitigate the runoff from their lease areas. Incentives could be in the form of penalties, or financial assistance, and would be based on the change in runoff from their lease area due to physical changes made by lessees.

Calculating Water Harvesting Potential

The table below is useful for calculating the water harvesting potential for building roofs. The example below calculates the potential water capture from 12,000 square feet of roof top. The calculator is set for Santa Fe, New Mexico rainfall statistics.

In the example below, the 12,000 square feet of roof top has the potential to harvest over 94,000 gallons of rainwater per year.

Santa Fe Area Runoff Potential	*Rainfall per month*	*Inches / gallons*	*SF of Roof*	*Gross gallons / month*	*Runoff coeff.*	*Total monthly yield*
January	0.65	0.405	12,000	4,859	0.9	4,373
February	0.74	0.461	12,000	5,532	0.9	4,979
March	0.79	0.492	12,000	5,906	0.9	5,315
April	0.94	0.586	12,000	7,027	0.9	6,325
May	1.33	0.829	12,000	9,943	0.9	8,949
June	1.05	0.654	12,000	7,850	0.9	7,065
July	2.35	1.464	12,000	17,569	0.9	15,812
August	2.17	1.352	12,000	16,223	0.9	14,601
September	1.52	0.947	12,000	11,364	0.9	10,227
October	1.11	0.692	12,000	8,298	0.9	7,469
November	0.62	0.386	12,000	4,635	0.9	4,172
December	0.71	0.442	12,000	5,308	0.9	4,777
Annual Total	13.98			104,514		94,063

Figure V-12: Above Ground Cistern

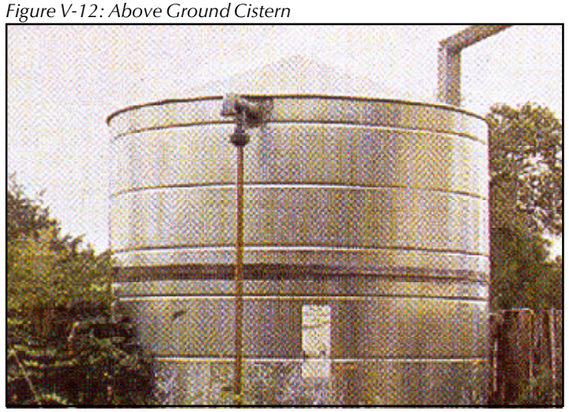


Figure V-13: Sanbusco Parking Lot Water Harvesting Median

Cisterns on New Buildings

The Master Plan recommends that above ground cisterns, (see *Figure V-12*), be required of new buildings in the Railyard. This is recommended in particular, to mitigate stormwater detention issues in the Baca Area. The collection of rainwater into cisterns reduces the amount of water that needs to be handled by stormwater detention ponds.

Above ground cisterns avoid the problem of saturating subsoils. In the event of a leak in the system, the flow occurs above ground, and if not allowed to pond, can avoid saturating the subsoils.

The benefit to the City is a reduced need for stormwater improvements for the Railyard. The benefit for the tenants is a source for landscape water that is not dependent on potable water sources. The benefit for the community is a City-wide model for water management and conservation.

In the North Railyard, the use of above ground cisterns would be similar to the benefits that can be gained from the Baca Area for the City, the tenants, and the community.

UTILITIES

Conventional utility grids are the current power sources for most modern buildings. In the future, as alternative power sources like active solar and fuel cell technology, and other resource conserving technologies become more readily available and affordable, the management of the Railyard site should encourage energy and resource conservation when evaluating new development proposals from potential, new, and existing tenants.

(Refer to *Figure V-14* for the Railyard Utilities Concept Master Plan.)

Dry Utilities

"Dry" utilities include electric, gas, communications, and cable television. Any above ground dry utility equipment such as transformers or pedestals may be articulated as part of the building design as allowed in the Architectural section of this Master Plan. New dry utilities should be installed underground. Existing overhead lines, where determined by Historic review to be part of the historic character of the site, shall be maintained.

Sanitary Sewer

All buildings within the railyard area should be connected to the City of Santa Fe sanitary sewer system. Whenever possible, these connections should be made by gravity flow. Construction of mainline extensions (as illustrated below in the Utility Master Plan) are required in order to facilitate gravity flow. New sanitary sewer lines must be ten (10) feet away from existing or proposed waterlines. These new sewer mains must be designed and constructed in accordance with City of Santa Fe Wastewater Management Division requirements.

Baca Street Area

There is no gravity sanitary sewer service to properties within the Baca Area. However, a sanitary sewer interceptor line runs along the north edge of the Acequia Madre, just north of the railyard property. There are existing waterlines in Cerrillos Road and along the east edge of the property.

Proposed system improvements include construction of a new sanitary sewer main from the existing interceptor, through the City-owned Well property and into the Baca Area. This line could serve the large majority of the site.

A small area immediately adjacent to Baca Street could be served by the existing line in Baca Street.

Proposed water system improvements consist of new main lines along the old rail line that runs through the site from Cerrillos Road to the existing lines near the water well. These water mains would provide for adequate flows and pressures for domestic and fire uses.

North Railyard

There are existing sanitary sewer and water mains in the public streets surrounding the North Railyard Area. Existing buildings obtain service from the existing main as previously described. Proposed sanitary sewer improvements include new sewer mains along the west edge of the site and along the east side of the railroad tracks. These improvements will allow for simple, low maintenance service lines to serve the proposed and existing buildings.

There is an existing sanitary sewer interceptor line that runs along the west edge of the site from Alarid Street to Paseo de Peralta, where it then turns and runs east along Paseo de Peralta. In addition, there is a standard eight inch main line that also runs in Paseo de Peralta.

Sanitary sewer service to the two new buildings on the southside of Paseo de Peralta would be available via standard service connection to the existing eight inch sewer main running along the south edge of Paseo de Peralta. Other buildings could tie into a new eight inch main which would then tie into the existing interceptor line.

Proposed water system improvements include a new water main which would connect to the existing main in Cerrillos Road and come across the park, under the railroad tracks, then north along the west property line to Paseo de Peralta. This new waterline would provide the required fire and domestic flows for development proposed within the south railyard area.

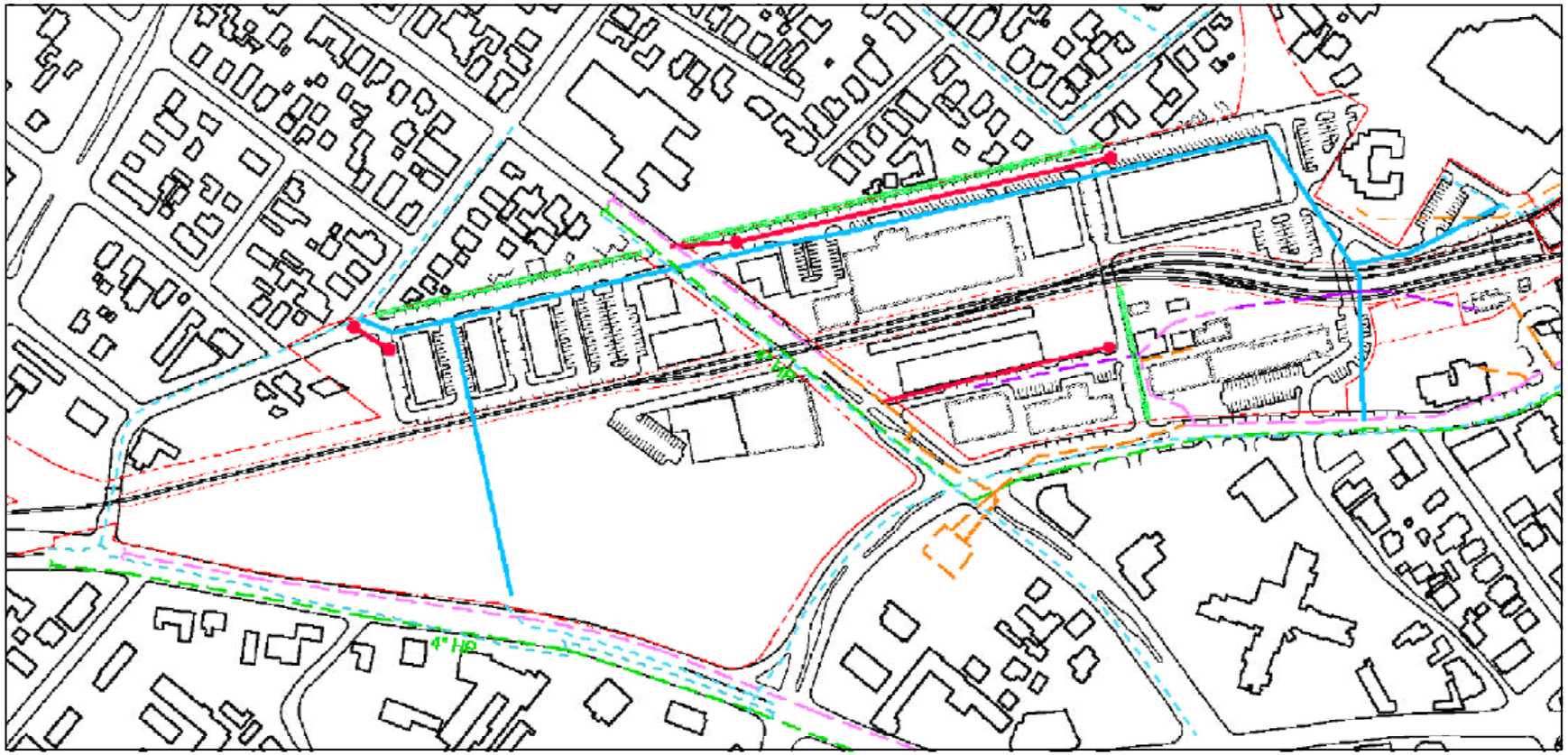


Figure V-14: Utilities Concept Master Plan

LEGEND

- Existing Sanitary Lines
- Existing Sanitary Manholes
- Existing Water Lines
- Potential Sanitary Sewer System Improvments
- Potential Water System Improvements
- Existing Arroyo or Swale
- Existing Gas Lines
- Existing Overhead Electrical Lines (Single Phase)
- Existing Electrical Lines (3-Phase)
- Existing Underground Electric Lines (3-Phase)