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Use of Produced Water in Recirculating Cooling Systems at Power Generating Facilities

Deliverable Number 2
Infrastructure Availability and Transportation Analysis

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Disclaimer

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Abstract

The purpose of this study is to evaluate produced water as a supplemental source of water for the San Juan Generating Station (SJGS). This study incorporates elements that identify produced water volume and quality, infrastructure to deliver it to SJGS, treatment requirements to use it at the plant, delivery and treatment economics, etc.

SJGS, which is operated by Public Service of New Mexico (PNM) is located about 15 miles northwest of Farmington, New Mexico. It has four units with a total generating capacity of about 1,800 MW. The plant uses 22,400 acre-feet of water per year from the San Juan River with most of its demand resulting from cooling tower make-up. The plant is a zero liquid discharge facility and, as such, is well practiced in efficient water use and reuse.

For the past few years, New Mexico has been suffering from a severe drought. Climate researchers are predicting the return of very dry weather over the next 30 to 40 years. Concern over the drought has spurred interest in evaluating the use of otherwise unusable saline waters.

Deliverable 2 focuses on transportation – the largest obstacle to produced water reuse in the San Juan Basin (the Basin). Most of the produced water in the Basin is stored in tanks at the well head and must be transported by truck to salt water disposal (SWD) facilities prior to injection. Produced water transportation requirements from the well head to San Juan Generating Station (SJGS) and the availability of existing infrastructure to transport the water are discussed in this deliverable.

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Executive Summary

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The Study Area generated about 53,900 BPD of produced water in 2003. Three areas of high-volume produced water generation are identified – Close-in production (12,520 BPD) in the Kirtland area, Fairway production (20,680 BPD) at the New Mexico-lColorado border and Tri-City production (2,760 BPD) in the Aztec-Bloomfield-Farmington area.

Bloomfield is the hub of oil and gas production and processing in northwest New Mexico and is home to five gas processing plants and one oil refinery. Consequently, there are a number of major gas transmission lines in the Study Area. The demand for new pipelines has eliminated any heretofore excess capacity that may have existed. A number of major natural gas pipeline companies were contacted to determine the availability of abandoned or underutilized pipeline – all existing pipeline assets are fully utilized.

Burlington Resources identified two abandoned pipelines that could be used to gather produced water – the CO_2 Gas Line and the Hart Canyon Line. The CO_2 Gas Line originates close to Bloomfield and threads its way past a number of SWDs and terminates close to the New Mexico-Colorado border in the center of the Fairway Production Area. The Hart Canyon line extends north from Bloomfield and is situated between the Tri-City and Fairway Production Areas. Both lines are well situated and could be used for produced water gathering.

Given the orientation of the three high production areas in the Study Area and the orientation of the CO_2 Gas Line and the Hart Canyon Line, four gathering, staging and conveyance strategies emerged:

- Use the existing CO_2 Gas Line and the Hart Canyon Line to gather produced water from the Tri-City and Fairway Areas.
- A Collection Center could be constructed in Bloomfield to accept and pretreat produced water prior to conveyance to SJGS.
- A new 28.5-mile pipeline could be constructed to convey produced water from the Collection Center in Bloomfield to SJGS.

- Gather produced water directly from two or more Close-in Area producers using the new Bloomfield-to-SJGS produced water pipeline.

As a result of recent legislative actions and given the cost of new infrastructure, PNM is evaluating a two-phased approach to using produced water at SJGS. In Phase 1, a new 11-mile pipeline would be built to gather and convey Close-in production from the Kirtland area to SJGS. In Phase 2, Fairway and Tri-City production would be gathered utilizing the CO_2 Gas Line and the Hart Canyon Line.

There are two additional sources of produced water in the Study Area that should be investigated. A large independent disposal operation in the vicinity of the Collection Center in Bloomfield could provide up to 10,000 BPD of produced water. SWDs that can be utilized to pump filtered produced water to the project may also have the ability to backflow formations that formerly accepted produced water for an additional 10,000 BPD.

2.1 Introduction

Transportation is the largest obstacle to produced water reuse in the San Juan Basin (the Basin). Most of the produced water in the Basin is stored in tanks at the well head and must be transported by truck to salt water disposal (SWD) facilities prior to injection. Depending on the location of a well, one-way transport can exceed several hours. Also, relative to other producing areas in the United States, water generation in the Basin is spread over a large area, i.e. wells are on 80-acre parcels in the Basin[1] as compared to 100-foot centers (or less) in parts of Texas, Oklahoma and California. Produced water transportation requirements from the well head to San Juan Generating Station (SJGS) and the availability of existing infrastructure to transport the water are covered in this deliverable.

There is a broad network of oil and gas gathering and transmission pipelines in the San Juan Basin. In a typical operation, oil and/or gas are separated from produced water at the well head. The majority of hydrocarbon production in the Basin is natural gas. Gas is compressed at the well head and fed to a network of gathering lines where it can be stored and pre-treated (at an intermediate facility) and transported to a gas treating facility in Bloomfield, New Mexico or outside the Basin. Gas treatment consists of water and CO_2 removal, de-sulfurization and the separation and/or blending of different hydrocarbon constituents, e.g. methane, ethane, propane, etc. From Bloomfield, treated gas is transported to points north, south or west via gas transmission lines. Oil is usually stored at the well head and trucked to a central location for delivery by truck or pipeline to the Giant Refinery[2] in Bloomfield where it is de-sulfurized and processed into gasoline, diesel, heavy fuel oils, etc.

SJGS, which is operated by Public Service of New Mexico (PNM), is located about 18 highway miles west of the center of Farmington, New Mexico and 30 miles west of Bloomfield. Refer to Figure 2.1, for a depiction of the Study Area. Also, SJGS is located on the western edge of the Fruitland Petroleum System (the Fruitland) placing it just outside of areas of oil and gas production. The Study Area, as described in Deliverable 1, Produced Water Assessment, is 31 miles wide by 84 miles long at its greatest dimensions. Produced water is generated in 69 of the 78 townships in the Study Area. Refer to Figure 2.2 for produced water generation by township.

2.2 Produced Water Generation

The Study Area was established to identify produced water that is reasonably close to SJGS. There were 19,090 oil and gas wells listed as active in the Basin in New Mexico in 2003[3] (13,600 wells in the Study Area). Wells in the Basin generated about 68,500 BPD of produced water – 53,900 BPD in the Study Area.

[1] The Bureau of Land Management (BLM) just increased the limit from one well per 160 acres to one per 80 acres on federal lands.
[2] The Giant refinery in Gallup, New Mexico, which is 100 miles SSW of Bloomfield, may also receive oil from the Basin.
[3] Reported by the Oil Conservation Division (OCD). Oil and gas production statistics are compiled and made available to the public on their website at www.emnrd.state.nm.us/ocd.

Figure 2.1

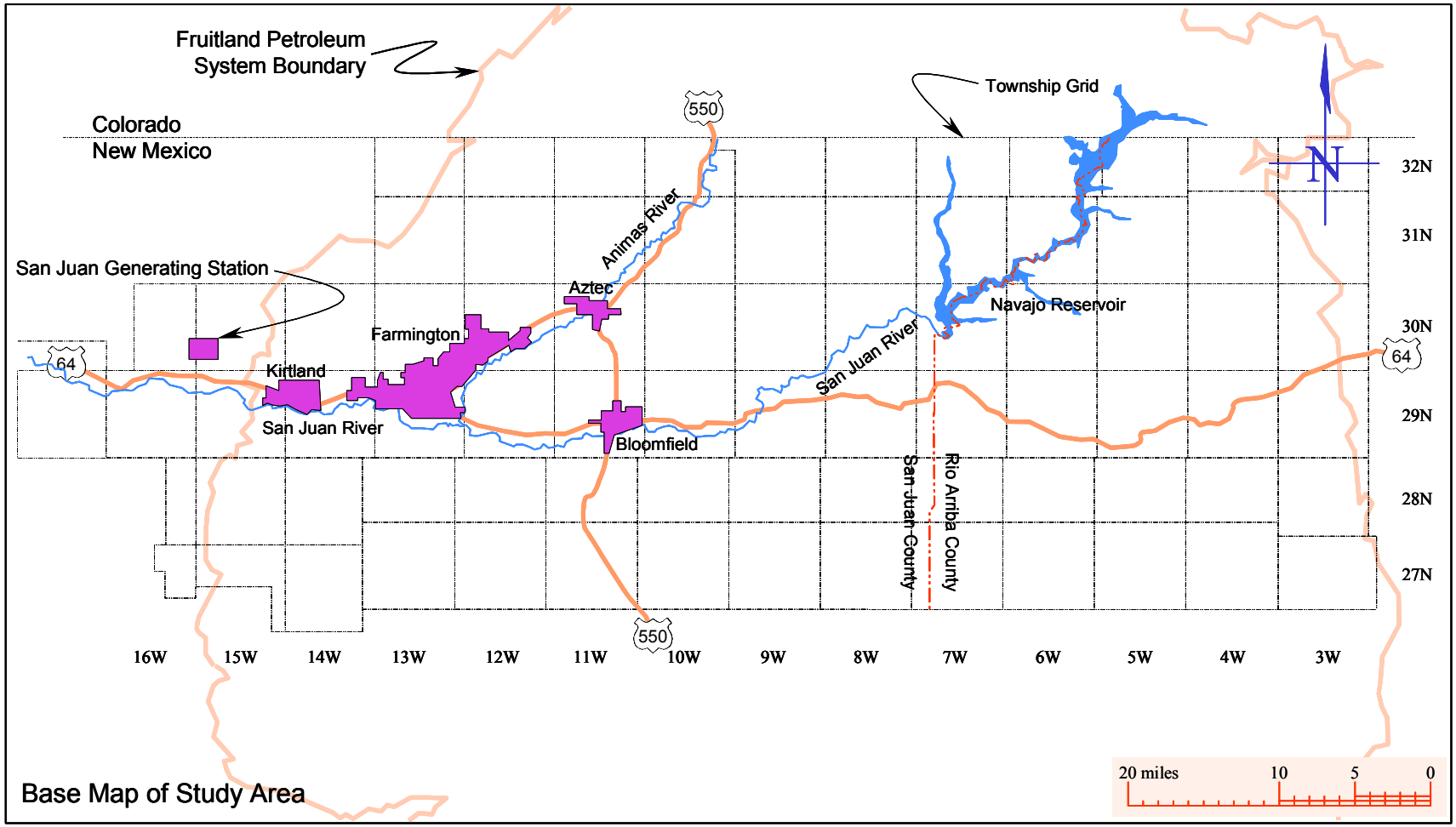
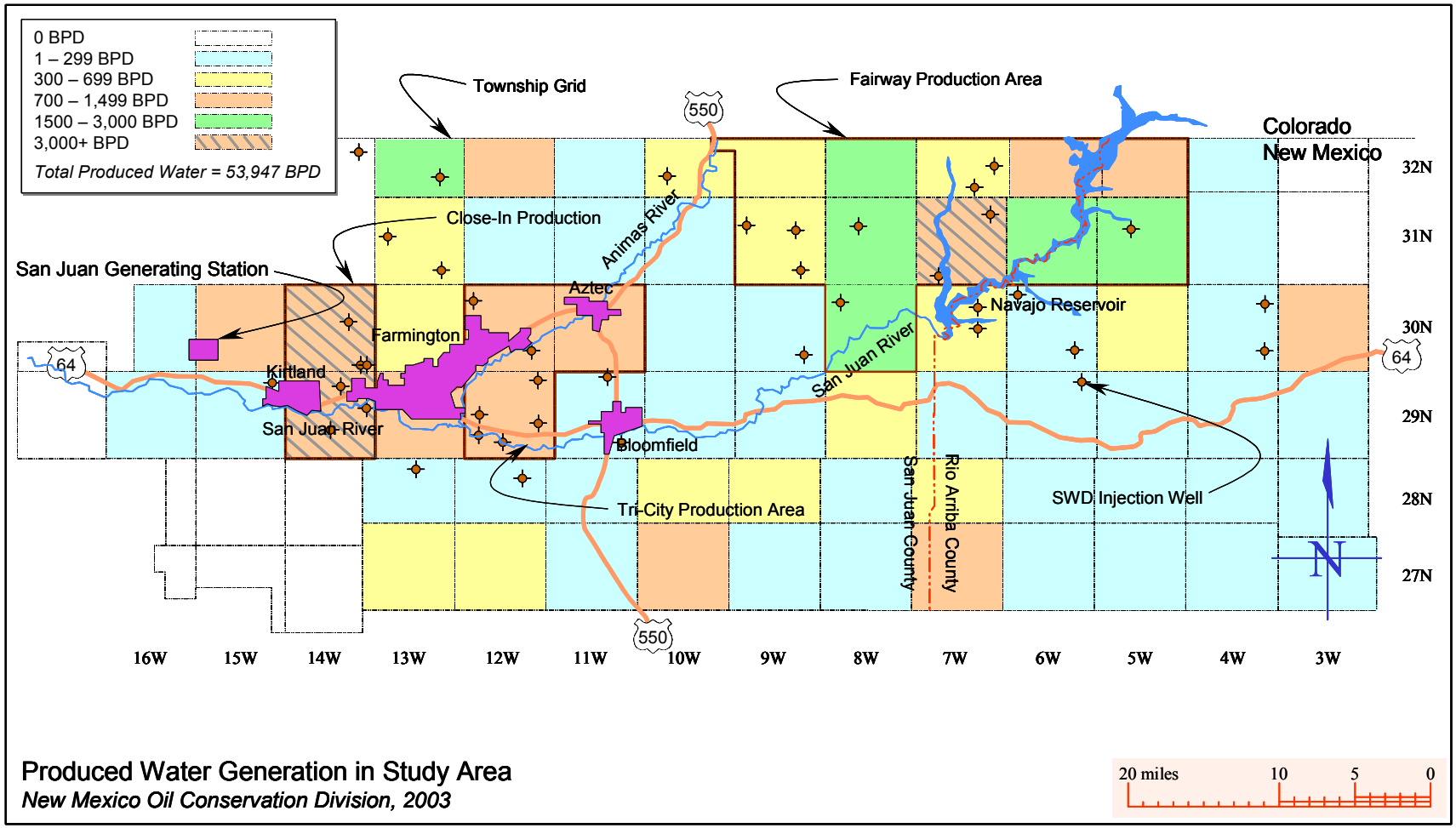

Fruitland Petroleum
System Boundary
Colorado
New Mexico
Township Grid
550
Animas River
San Juan Generating Station
Aztec
Farmington
Navajo Reservoir
64
Kirtland
San Juan River
San Juan River
Bloomfield
San Juan County
Rio Arriba County
32N
31N
30N
29N
28N
27N
16W
15W
14W
13W
12W
11W
10W
9W
8W
7W
6W
5W
4W
3W
20 miles
10
5
0
Base Map of Study Area

Figure 2.2



Produced Water Generation in Study Area

New Mexico Oil Conservation Division, 2003

A significant amount of produced water is generated in the Colorado portion of the San Juan Basin (just north of the Study Area). Compacts established between Colorado and New Mexico bar interstate transfers of water without the approval of their respective Offices of the State Engineer (OSE). Therefore, Colorado produced water collection, conveyance and reuse are not included this evaluation.

Refer to Table 2.1 for a summary of produced water generation in the Study Area.

Table 2.1

Produced Water Generation	Townships	Township Volume (barrels)	Percent of Total	Cumulative Volume (barrels)
0 BPD	8	0	0.0%	0
1 to 299 BPD	36	5,022	9.3%	5,022
300 to 699 BPD	14	6,680	12.4%	11,702
700 to 1,499 BPD	11	10,619	19.7%	22,321
1,500 to 2,999 BPD	6	14,504	26.9%	36,825
3,000+ BPD	3	17,122	31.7%	53,947
Total	78	53,947	100.0%	

Produced water generation patterns for the Study Area are summarized below:

- About 42,000 BPD or 80 percent of the produced water in the Study Area is generated north of or at Highway 64.
- 20 townships produce more than 700 BPD of water in the Study Area and generate 29,400 BPD or 70 percent of the produced water in the Study Area. Fifteen of these townships are located at or north of Highway 64.
- Two townships on the western edge of the Fruitland generate the most produced water in the Study Area – 12,516 BPD or 23 percent of the daily volume in the Study Area.
- Two of the high-volume townships are split by the San Juan River and two townships are south of it. Produced water south of Highway 64 comprises a small fraction (about 10 percent) of available water in the Study Area and is generally more saline.

2.2.1 Areas of High-Volume Production

Three areas of high-volume produced water generation in the Study Area are also identified in Figure 2.2 and are designated in this deliverable as:

- Close-in production (12,520 BPD) in two Kirtland area townships – 30N14W and 29N14W (which is bisected by the San Juan River) – about 5 to 10 miles from SJGS
- Fairway production (17,760 BPD) in ten townships from 31N to 32N and 5W to 9W
- Tri-City production (2,760 BPD) in three townships in the Aztec-Bloomfield-Farmington area.

These areas were selected for several practical reasons:

- Close-in production is in the vicinity of SJGS (the plant can be seen from many of the well heads).
- There is pipeline infrastructure that runs west and north of Bloomfield to Fairway production.
- Produced water that is trucked to SWDs in the Tri-City Area (as well as surrounding low-volume areas) could easily be re-routed to existing (or new) infrastructure.

It is noteworthy that most of the SWDs in the Study Area are situated in areas of high water production – shorter distances to injection wells reduce transportation costs[4]. Additionally, there are only a handful of SWDs south of Highway 64 (mostly because of reduced water production). This water must be transported north at substantial cost to the producers.

Infrastructure and the rationale for transporting produced water from high-volume areas are discussed in more detail later in this deliverable.

2.3 Major Gas Transmission Infrastructure

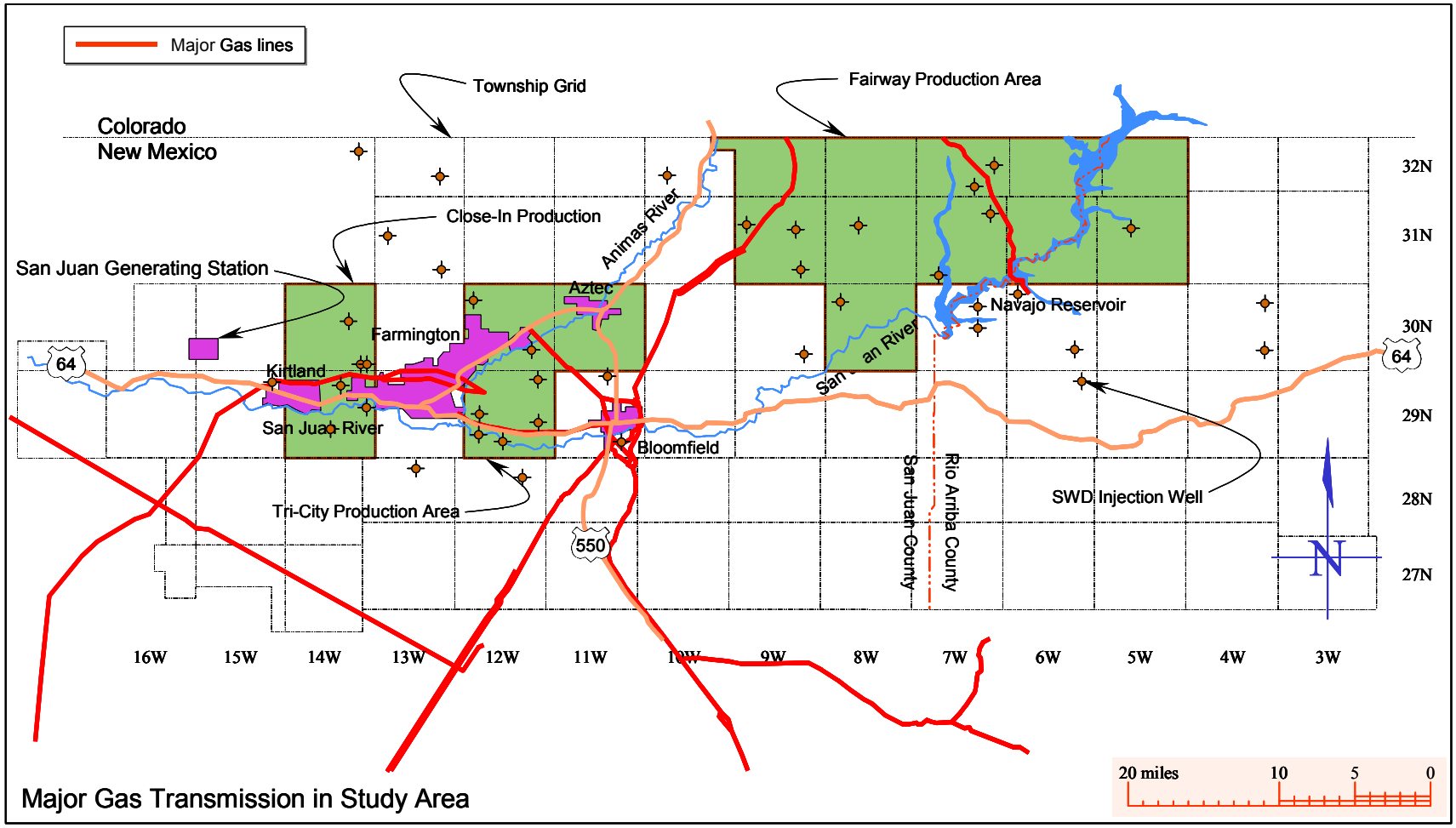
Bloomfield is the hub of oil and gas production and processing in northwest New Mexico and is home to five gas processing plants and one oil refinery. Consequently, there are a number of major gas transmission lines in the Study Area. Refer to Figure 2.3. At the start of this project, it was assumed that abandoned or underutilized gas transmission lines could provide an ideal means of conveying produced water from areas of high-volume production to SJGS. Gas transmission rights-of way could also provide an established path for a new produced water pipeline to SJGS.

In the past few years, however, the demand for natural gas has skyrocketed in the western United States. Numerous gas-fired combined cycle power plants[5] have come online in California, Arizona and Nevada. Increased demand and the need to move greater volumes of natural gas have created a shortage of gas transmission infrastructure. This has spurred new pipeline construction to transport gas from Texas, Oklahoma, New Mexico and Colorado to western states. The demand for new pipelines has eliminated any heretofore excess capacity that may have existed. A number of major natural gas pipeline companies were contacted to determine the availability of abandoned or underutilized pipeline – all existing pipeline assets are fully utilized. Even older/low pressure lines are being kept in service and used for gathering purposes.

As stated previously, natural gas transmission line rights-of-way could provide established pathways to SJGS and several gas pipeline companies have stated (in principle) that their rights-of-way could be made available for a produced water pipeline.

[4] Transportation by tanker truck (250 barrel capacity) accounts for 50 to 80 percent of produced water handling costs depending on the well head distance to SWDs.
[5] Combined cycle plants utilize a gas turbine to drive an electric generator and a heat recovery steam generator (utilizing the hot exhaust from the gas turbine) to drive a steam turbine/electric generator. Natural gas is the primary fuel source for gas turbines.

Figure 2.3


Major Gas lines
Township Grid
Fairway Production Area
Colorado
New Mexico
Close-In Production
San Juan Generating Station
Animas River
Aztec
Navajo Reservoir
Farmington
Kirtland
San Juan River
Bloomfield
Tri-City Production Area
SWD Injection Well
San Juan County
Rio Arriba County
64
550
32N
31N
30N
29N
28N
27N
16W
15W
14W
13W
12W
11W
9W
8W
7W
6W
5W
4W
3W
N
20 miles
10
5
0
Major Gas Transmission in Study Area

2.4 Other Pipeline Infrastructure

Burlington Resources, the largest producer in the Basin, was also consulted to determine the extent of pipeline infrastructure in the Basin that could be used for transporting produced water. They were also instrumental in identifying how produced water is handled, i.e. separated from oil and/or gas at the well head, transported to SWDs and treated prior to deep-well injection.

Burlington Resources identified two abandoned pipelines that could be used to gather produced water:

- CO_2 Gas Line – 4" high-pressure carbon steel line originally constructed to transport CO_2 to evaluate a production technique to displace methane from coal.
- Hart Canyon Line – 4" high-pressure carbon steel line previously used to transport produced oil to the refinery in Bloomfield.

Both lines are owned by Burlington Resources and are preserved-in-place for possible future service. Refer to Figure 2.4. The CO_2 Gas Line originates close to Bloomfield and threads its way past a number of SWDs and terminates close to the New Mexico-Colorado border in the center of the Fairway Production Area. The Hart Canyon line extends north from Bloomfield and is situated between the Tri-City and Fairway Production Areas. As discussed next, both lines are well situated and could be used for produced water gathering.

Lastly, discussions with other large producers (by way of introductions from Burlington Resources) did not yield any other significant infrastructure. Many lines have been abandoned and not preserved-in-place so the condition of this buried pipe is presumed poor. Some lines have been cut and the remaining sections re-routed. Many of the unused segments are short and of little use.

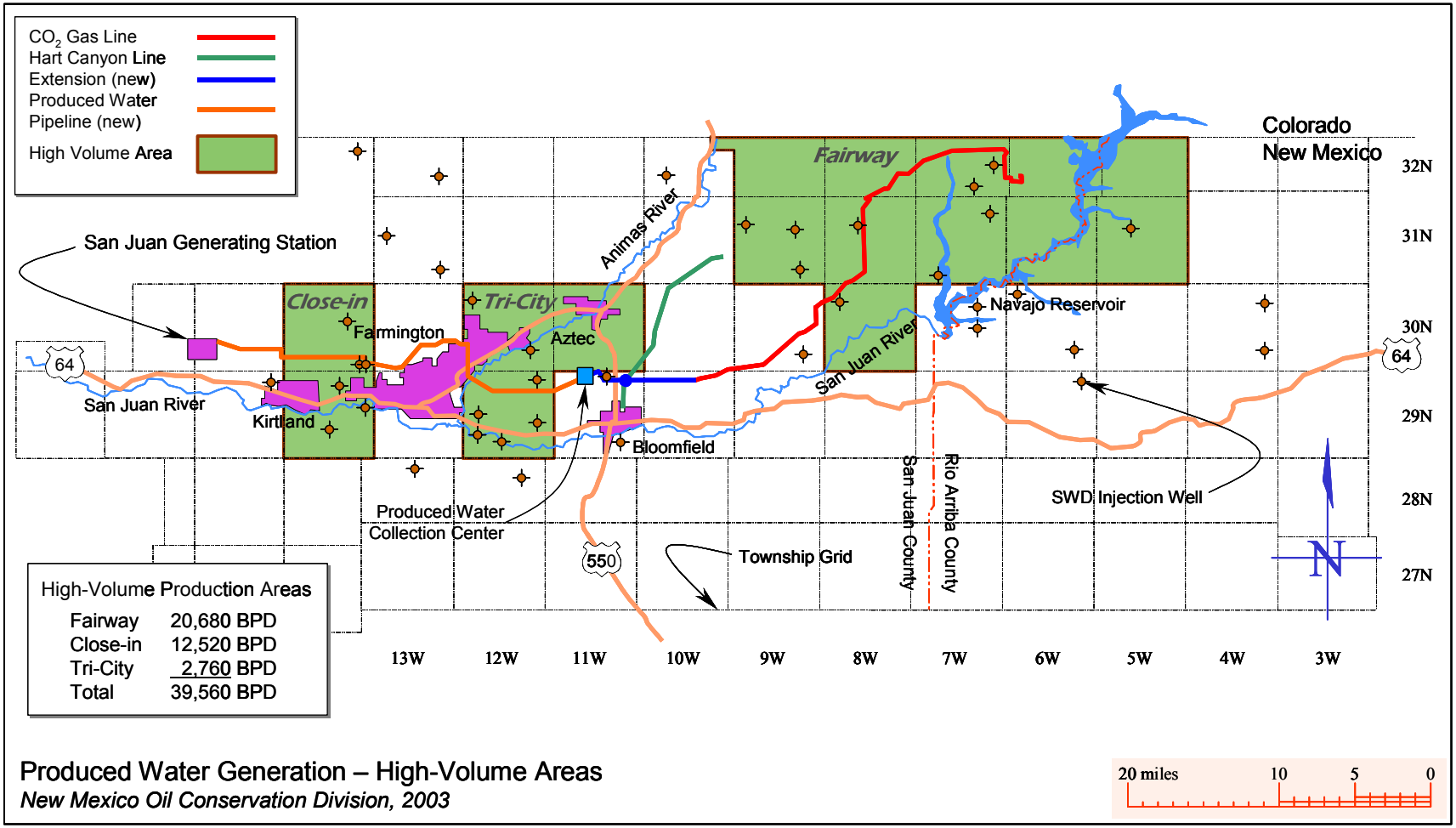
2.5 Produced Water Gathering, Staging and Conveyance

Given the orientation of the three high production areas in the Study Area and the orientation of the CO_2 Gas Line and the Hart Canyon Line (refer to Figure 2.4), four gathering, staging and conveyance strategies emerged:

- Use the CO_2 Gas Line and the Hart Canyon Line to gather produced water from the Tri-City and Fairway Areas.
- A Collection Center could be constructed in Bloomfield to accept and pretreat produced water prior to conveyance to SJGS.
- A new pipeline could be constructed to convey produced water from the Collection Center in Bloomfield to SJGS.
- Gather produced water directly from two or more Close-in Area producers using the new Bloomfield-to-SJGS produced water pipeline.

Refer to Figure 2.5 for a schematic of the gathering, staging and conveyance strategies.

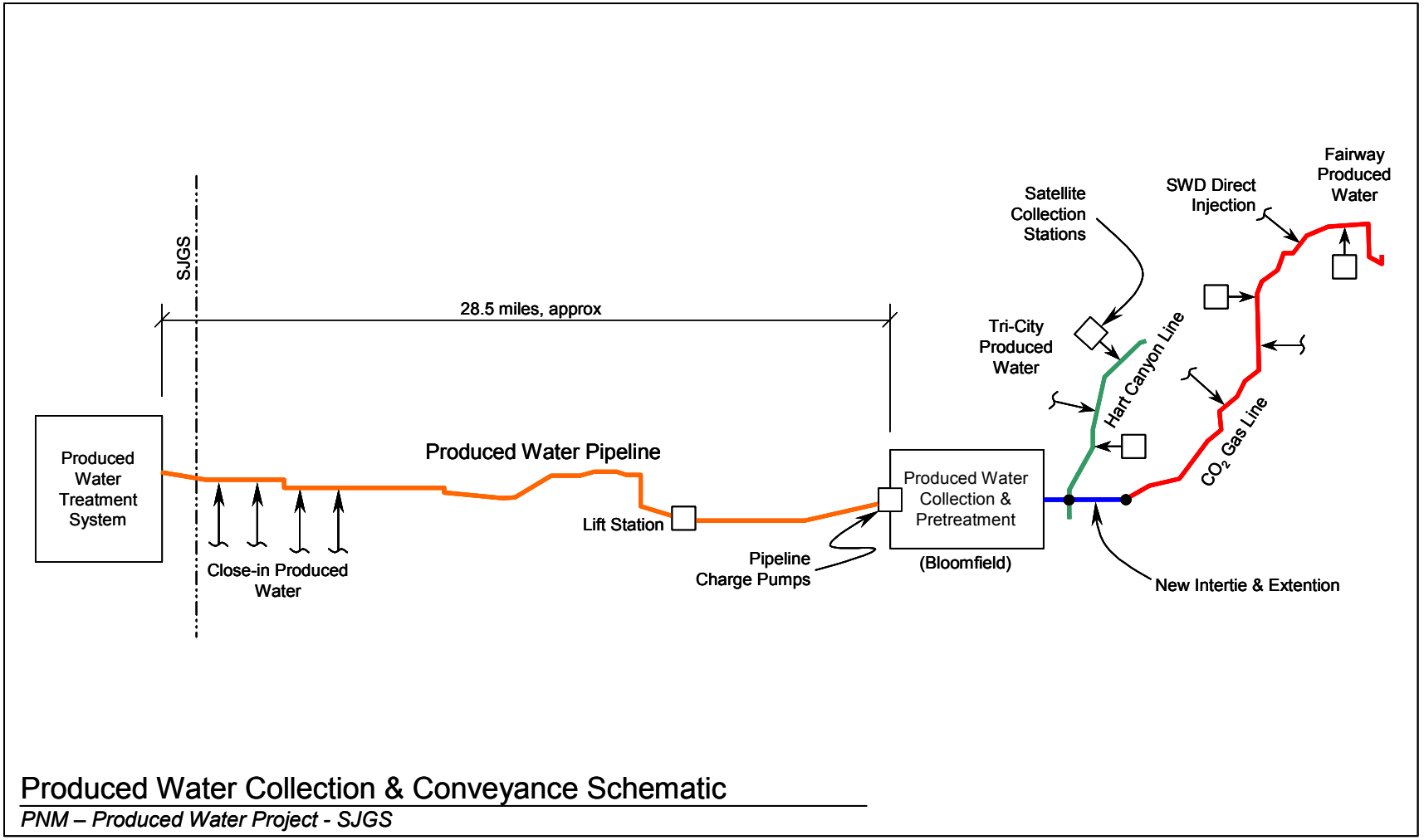
Figure 2.4



Produced Water Generation – High-Volume Areas

New Mexico Oil Conservation Division, 2003

Figure 2.5



Produced Water Collection & Conveyance Schematic

PNM – Produced Water Project - SJGS

2.5.1 CO_2 Gas Line and Hart Canyon Line

The CO_2 Gas Line and the Hart Canyon Line provide a convenient and direct means of gathering produced water from the Tri-City and Fairway Areas. Given their relative orientation, they could either be tied together and routed (as a new line) to a collection point, or depending on the location of the collection point, they could be routed to it separately. After discussions with Burlington Resources, it was determined that it would be more practical to combine the produced water flow of the CO_2 Gas Line and the Hart Canyon Line and route a new extension line to the Collection Center.

The CO_2 Gas Line and the Hart Canyon Line would receive produced water from a series of injection points – possibly three to four in each line (the CO_2 Line could have more because of its greater length). Refer to Figure 2.5. Two means of injection surfaced in discussions with Burlington Resources:

- Satellite collection stations would receive produced water from transport trucks. They would be located in areas of high traffic to optimize daily volume. Each station would have a receiving tank, transfer pumps and filters and on a pre-programmed schedule would inject filtered produced water into either the CO_2 Gas Line or Hart Line. Each truck would be given an electronic identification card to track who used the system. In the event there was a problem with either vandalism or improper disposal of a waste product, specific operators would be prohibited from disposing of produced water.
- SWD direct injection would be used for a number of nearby injection wells. SWD operations remove oil and grit from produced water and filter it before injection to the protect the well and receiving formation. Filtered water would be injected into either the CO_2 Gas Line or Hart Line.

2.5.2 Collection Center in Bloomfield

The Collection Center in Bloomfield would be used to:

- Receive produced water via the intertie/extension of the CO_2 Gas Line and Hart Line.
- Remove oil and grit using a three-step process – API gravity/coalescing separation, dissolved air flotation and walnut shell filtration.
- Equalize chemistry via storage to reduce variations in produced water salinity.
- Monitor water quality prior to charging the conveyance pipeline – oil content, suspended solids, pH, salinity, etc.

Water to be transported in the Bloomfield-to-SJGS pipeline must be free of oil, grit and suspended matter to protect its integrity. Final water treatment (desalinization) could be also done at the Collection Center in Bloomfield rather than SJGS, however, the environmental and economic issues associated brine and sludge disposal will likely preclude this. Produced water handling, pretreatment, conveyance and treatment alternatives are discussed in Deliverable 3, Treatment and Disposal Analysis.

Lastly, re-routing produced water transport trucks to the Collection Center in Bloomfield (or to SJGS) was not considered feasible. Trucking is the largest cost component of handling, treating and injection produced water, so hauling water extra distances would only raise the cost of disposal for the producers (and discourage participation in

produced water reuse). Also, there are times when trucks deliver fluids to SWDs that cannot be injected. It was felt that the SWD operators were better equipped to monitor/control this activity.

2.5.3 Produced Water Conveyance

A 28.5-mile 16-inch pipeline would be required to convey produced water from the Collection Center in Bloomfield to SJGS. PNM enlisted the services of a local engineering firm to evaluate pipeline routes and costs as well as identify locations for the Collection Center. The most cost effective route is shown in Figure 2.4. The route selected is the shortest and takes advantage of PNM transmission right-of-way the last third of the pipeline length. The pipeline would be constructed of high-density polyethylene (HDPE) and would consist of charging pumps, a mid-length lift station and clean-out stations along its length. The elevation change of the line is predominantly downhill but there are several lifts that must be overcome. The line would be designed for an operating pressure of approximately 200 psi. The line was purposely sized large to accommodate up to 60,000 BPD of produced water (50,000 BPD during peak collection years is the likely flow rate) in the event additional water is available from future increased gas production. Refer to Table 2.2 for pipeline design information and costs.

2.5.4 Close-in Area Produced Water

Close-in Area CBM (coal bed methane) production from the Kirtland area would be collected directly by the new Bloomfield-to-SJGS pipeline. Typically, CBM water has no measurable free oil[6] content. In comparison, conventionally produced oil and gas can have very high levels of free oil products (in excess of 500 mg/l). Simple filtration is all that is necessary to pretreat the CBM produced water before it is injected into the pipeline. Producers already filter the water prior to injection so they would not have to perform any special treatment prior to the pipeline. Refer to Figures 2.4 and 2.5. Produced water would be collected from the two major gas producers in townships 29N14W and 30N14W, Dugan Production Corporation and Richardson Operating Company. In addition to produced water, cooling tower blowdown from Prax Air (a small industrial operation in Kirtland, New Mexico) and water from the BHP Billiton mine (coal supplier to SJGS) can readily be picked up by the pipeline[7] because it passes both of these operations. Prax Air and BHP Billiton would also pump their water into the pipeline.

[6] CBM gas is collected directly from coal bed seams. The seams are fractured to allow trapped gas and water to escape. Separable hydrocarbons in the coal are usually in the form of methane gas. It is rare to find higher molecular weight hydrocarbons (in liquid form) such as butane or pentane.

[7] Their contribution to would amount to 1,400 BPD of a possible 40,000 BPD project, about four percent of total project flow.

Table 2.2

Pipeline Details and Costs

PNM - Produced Water Project - SJGS

Design Information		
Design Flow Rate	BPD	60,000
	AF/yr	2,823
	gpm	1,750
Pipeline Length	miles	28.5
Pipeline Diameter	inches	14
Pipeline Material		HDPE
Clean-out Stations		10
Charge Pressure	psi	300
Lift Pressure	psi	300
Charge/Lift Power	kw	328
Installation Costs		
Charge Pumps		$580,000
Pavement Replacement		$110,000
Boring & Casing		$1,190,000
Pipe		$5,420,000
Valves, Fittings, etc.		$1,050,000
Lift Station		$580,000
Mob, Staking, Surveying, etc.		$850,000
Other		$920,000
Right of Way		$950,000
Design, Const Oversight		$1,250,000
Subtotal		$12,900,000
Contingency	15%	$1,940,000
NMGRT (4)	6.125%	$790,000
PNM G&A (5)	5.5%	$710,000
Total Installed Cost		$16,340,000
Annual Operating Costs		
Power (1)		$144,000
Operators (2)		$0
Maintenance (3)		$65,000
Total Operating Cost		$209,000

Notes…..

1. Offsite power at $0.05/kwh.
2. Operator coverage from SJGS and the Collection Center.
3. Maintenance at 0.5% of capital cost.
4. NMGRT is the New Mexico Gross Receipts Tax.
5. G&A is a "general and Administrative" charge applied to all PNM projects.

2.6 Other Sources of Produced Water

There are two additional sources of produced water in the Study Area that should be investigated. Both could further enhance produced water recovery volume.

There is a large independent disposal operation is the vicinity of the Collection Center in Bloomfield (about three miles east) that injects approximately 10,000 BPD of produced water. Many small and intermediate-sized producers utilize their services in lieu of installing their own injection facilities. Typical of SWDs, the facility pretreats produced water (oil and grit removal followed by and filtration) prior to injection. This operation should be considered a possible resource and investigated further.

Those SWDs that can be utilized to pump filtered produced water to the CO_2 Gas Line, Hart Line or directly into the Bloomfield-to-SJGS pipeline may also have the ability to backflow formations that formerly accepted produced water. Oil company geologists[8] feel that many injection wells (not all) can be used for this purpose. To accomplish this, a pump would have to be inserted into an injection well (capable of backflowing) to extract produced water. It is felt that the McGrath SWD (operated by Burlington Resources) could be converted to a backflow well, capable of generating up to 5,000 BPD of previously-injected produced water. An additional 10,000 BPD of produced water may be available in the Study Area from backflowing.

2.7 Recent Legislative Changes and Phased Implementation

As summarized in Deliverable 1, Produced Water Assessment, a bill allowing the "disposal" of produced water use at electric generating facilities was proposed in the 2004 New Mexico legislative session. The bill had two provisions. First, produced water reuse would be designated as an alternate method of disposal (rather than a beneficial use). Second, tax credits would be granted for using produced water at a power plant. Beneficial use of produced water was a major obstacle to oil and gas producer participation in any water reuse plan[9]. Also, tax credits are required to help pay for the new infrastructure[10] necessary to convey produced water from Bloomfield to the SJGS. The provision allowing disposal at a power plant passed, however, the tax credit did not. If the tax credit provision is to be pursued, it must be reintroduced in an upcoming legislative session.

As a result of these legislative actions and given the cost of new infrastructure, PNM is evaluating a phased approach to using produced water at SJGS:

Phase 1. Build a new 11-mile pipeline to gather and convey Close-in production from the Kirtland area to SJGS. The pipeline would be either be sized to just accommodate Close-in produced water daily volume to minimize front-end project costs, or sized to accommodate full-project throughput.

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[8] Discussions with geologists at Burlington Resources and Dugan Production Corporation.

[9] Under beneficial use, a right to use the water must be obtained. Also, it must be demonstrated that the produced water being considered has no hydrologic connection to other waters of the state. The regulatory and environmental protection afforded by the OCD (designating the water as a byproduct of oil and gas production) would have been lost to producers with beneficial use.

[10] Infrastructure includes the produced water collection and treatment center in Bloomfield and the 28.5-mile pipeline.

Phase 2. Gather Fairway and Tri-City production utilizing the CO_2 Gas Line and the Hart Canyon Line. This alternative would involve Burlington Resources as a project participant. A new Collection Center would be built in the Bloomfield area to pre-treat (and possibly treat for end use) produced water. The Phase 1 portion of the pipeline would be extended an additional 17.5 miles or a new 28.5-mile pipeline would be built from the Collection Center to SJGS. The implementation of this phase will be influenced by passage of the tax credit legislation.

Specific project details are discussed in Deliverable 7, Implementation Requirements.

2.8 Summary

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- Use the existing CO_2 Gas Line and the Hart Canyon Line to gather produced water from the Tri-City and Fairway Areas.
- A Collection Center could be constructed in Bloomfield to accept and pretreat produced water prior to conveyance to SJGS.
- A new 28.5-mile pipeline could be constructed to convey produced water from the Collection Center in Bloomfield to SJGS.
- Gather produced water directly from two or more Close-in Area producers using the new Bloomfield-to-SJGS produced water pipeline.

As a result of recent legislative actions and given the cost of new infrastructure, PNM is evaluating a two-phased approach to using produced water at SJGS. In Phase 1, a new 11-mile pipeline would be built to gather and convey Close-in production from the Kirtland area to SJGS. In Phase 2, Fairway and Tri-City production would be gathered utilizing the CO_2 Gas Line and the Hart Canyon Line.

There are two additional sources of produced water in the Study Area that should be investigated. A large independent disposal operation in the vicinity of the Collection Center in Bloomfield could provide up to 10,000 BPD of produced water. SWDs that can be utilized to pump filtered produced water to the project may also have the ability to backflow formations that formerly accepted produced water for an additional 10,000 BPD.